LANDMARKS AND SURFACE MARKINGS OF THE HUMAN BODY

RAWLING'S LANDMARKS AND SURFACE MARKINGS OF THE HUMAN BODY

NINTH EDITION

REVISED BY

J O ROBINSON M D M Chir F R C S
S RGICAL C A STANT ST B THOLOM W S HOSPITAL
FORME Y D M STRATO O ANATO Y ST B THOLOMEW'S HOSPITA

WITH THIRTY EIGHT ILLUSTRATIONS



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ILLUSTRATIONS

LANDMARKS AND SURFACE MARKINGS OF THE HUMAN BODY

CHAPTER I

THE HEAD AND NECK

Cranio-cerebral Topography

Only those landmarks and surface markings will be given which are of practical value and as far as possible each landmark will be rendered independent of any other as by such means any given structure can be rapidly depicted on the surface the important question of time and of space rendering the more complicated systems in which it is necessary to map out a network of intersecting lines in order to fix the position of any single structure of little surgical value It is necessary however to recognize first certain important bony points etc

The *nasion* situated at the base of the nose at the
Fig 1 1 central point of the naso frontal suture

The *inion* or *external occipital protuberance*
Fig 1 2 —a projection variable in size which can be felt on the occipital bone immediately above the nuchal furrow

A line uniting these two points over the vertex of the skull corresponds in direction to the *longitudinal fissure of the brain* to the upper attached margin of the *falx cerebri* and to the *superior sagittal venous sinus* This sinus originates in the region of the foramen cæcum just anterior to the crista galli of the frontal bone broadening out as it passes backwards to the internal occipital protuberance which corresponds on the outer aspect of the skull to the inion The sinus then turns sharply to

the right, forming the right *transverse sinus* The left sinus derives its blood mainly from the *straight sinus* which receives at the anterior margin of the tentorium cerebelli the great cerebral vein (Galen) and the *inferior* sagittal sinus which is contained in the free margin of the falx cerebri The line drawn as above from the nasion to the inion also corresponds in direction to the occasionally persistent *metopic* suture between the two halves of the frontal bone and to the *sagittal* suture between the two parietal bones

The frontal bone is separated off from the two parietal bones by the *coronal* suture, and the point of junction of the coronal and sagittal sutures is known as the *bregma* the site of the fœtal anterior fontanelle an opening which should be closed before the end of the second year Between the parietal and occipital bones the *lambdoid* suture lies and at the junction of the sagittal and lambdoid sutures the posterior fontanelle is situated closed at or soon after birth The point of
Fig 1 13
junction of the last two sutures is known as the *lambda* This point lies about 2½ inches above the inion or external occipital protuberance About 1 inch from its posterior superior angle and close to the sagittal suture the parietal bone is perforated by a small foramen —the parietal foramen—for the transmission of an emissary vein A line uniting the two foramina crosses the sagittal suture at a point known as the *obelion* The parietal bone is outwardly bulged at a point
Fig 1 11
rather above its centre forming the *parietal eminence*—this is more pronounced in the fœtal skull and indicates the point at which the single ossific nucleus makes its appearance

Turning now one's attention to the lateral aspect of the

Fig 1, 6 skull, the *temporal lines* should be examined They are two in number, superior and inferior, crossing the parietal bone rather below the junction of the middle and lower thirds cutting off the vault proper above from the temporal fossa below The ridges are often so feebly developed in this region that it may be necessary to verify their position by tracing them backwards from the zygomatic process of the frontal bone at which level the upper line is always well marked The temporal muscle arises from the inferior temporal line and from the temporal fossa below, whilst the overlying fascia the tem

Fig 1 5 poral fascia gains attachment to the *superior temporal line*—a feebly developed ridge which runs above and parallel to the inferior line

The *zygomatic process of the frontal bone* articulates with

Fig 11, 16 the corresponding process of the zygomatic bone and the articulation between the two processes is easily felt at the upper and outer border of the orbital cavity

The *marginal tubercle* a small prominence to be felt

Fig 1 12 along the posterior border of the frontal process of the zygomatic bone a short distance below the fronto-zygomatic suture

The *zygomatic process* of the temporal bone should be traced backwards towards the ear and an examination of the skull will show that this process divides in front of the ear into three roots the anterior merging into the articular eminence the middle helping in the formation of the post glenoid tubercle whilst the posterior or upper

Fig 11 13 14 Fig 1 17 root sweeps backwards above the external auditory meatus to become continuous with the suprameatal and supramastoid crests and to blend with the posterior curved end of the temporal line

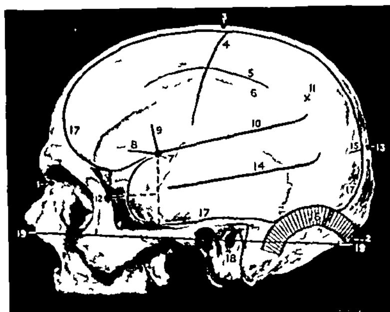
The *suprameatal crest* is of special surgical importance as it forms the upper boundary of Macewen's suprameatal triangle (aural operations) and also indicates fairly accurately the lower level of the cerebrum in this situation

The *transverse sinus*.—Draw a band ¾ inch in width
Fig I 16 from the inion or external occipital protuber-
Fig II, 19 ance to a point ¾ inch behind the external auditory meatus so curved that the highest *point of the* convexity lies about ¾ inch above Reid's base line

The *lower limit of the cerebrum* can be mapped out in
Fig I 17 the following manner A point is taken in the
17, 17 median antero-posterior line about ¼ inch above the nasion and from this point a line is drawn outwards which lies about ½ inch above, and follows the curve of the upper border of the orbit This line is carried backwards as far as the level of the zygomatic process of the frontal bone then curving upwards and backwards towards the *pterion* (see next page) The temporo sphenoidal lobe now sweeps downwards and forwards towards the posterior border of the zygomatic bone, and then lies practically on a level with the upper border of the zygomatic process of the temporal bone At and behind the ear the cerebrum lies flush with the suprameatal and supramastoid crests and subsequently follows the curve of the transverse sinus from the base of the mastoid process to the *external occipital protuberance*

The transverse sinus is to a large extent, walled in by the *tentorium cerebelli* a membrane separating the cerebrum above from the cerebellum below The *sinus curve* therefore corresponds not only to the position of the *transverse sinus* but also represents the outer attachment of the tentorium cerebelli and the interval between the cerebrum above and the cerebellum below

Reid's base line.—A line is drawn backwards from the


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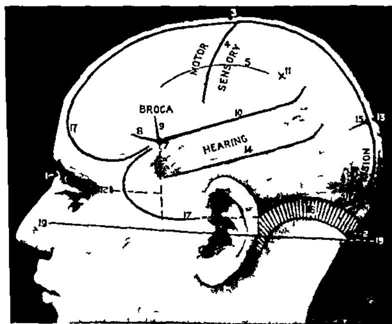
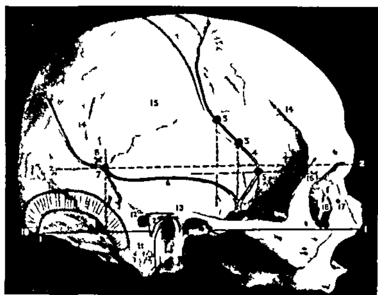

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FIG I

CRANIO-CEREBRAL TOPOGRAPHY



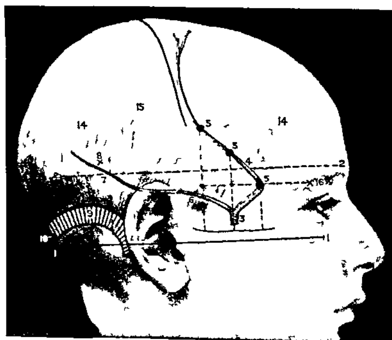


FIG I

1 The nasion
2 The inion
3 *The mid point between nasion and inion*
4 The central sulcus (fissure of Rolando)
5 The superior temporal line
6 The inferior temporal line
7 The pterion
8 The anterior horizontal ramus of the lateral cerebral sulcus (Sylvian fissure)
9 The anterior ascending ramus of the lateral cerebral sulcus
10 The posterior ramus of the lateral cerebral sulcus
11 The parietal prominence
12 The marginal tubercle of the zygomatic bone
13 The lambda
14 The superior temporal sulcus
15 The parieto-occipital sulcus
16 The transverse sinus
17 17 17 The level of the base of the cerebrum
18 The external auditory meatus
19 19 Reid s base line

FIG II

1 1 Reid's base line
2 2 A line parallel to the above at the level of the supra-orbital margin
3 The middle meningeal artery
4 The anterior branch
5 5 5 The three sites for trephining
6 The posterior branch
7 The site for trephining
8 The point for trephining to reach the inferior cornu of the lateral ventricle
9 The transverse sinus
10 The inion
11 The mastoid process
12 Macewen's suprameatal triangle
12*a* The tympanic antrum
12*b* The facial nerve
13 The suprameatal and supramastoid crests
14 14 The temporal line
15 The temporal fossa
16 The zygomatic process of the frontal bone
17 The site of attachment of the medial palpebral ligament (tendo oculi)
18 The lacrimal groove

Fig 1 19 / 19 Fig ii, 1 1 lower border of the orbit to the middle of the external auditory meatus and when further produced the line will be found to fall just below the level of the inion and to lie almost entirely below the level of the transverse sinus This line is utilized by some surgeons in trephining the skull distances being measured along this line and points taken above or below according to the seat of the lesion

The Sylvian point represents the site of divergence of Fig 1 7 the three rami of the *lateral cerebral sulcus* (Sylvius) It corresponds on the surface to a point known as the *pterion* which is situated 1¼ inches behind the zygomatic process of the frontal bone and 1¼ inches above the upper border of the zygomatic process of the temporal bone The main posterior ramus of the Fig 1 10 / 11 sulcus passes backwards and upwards from the Sylvian point to a second point situated ¾ inch below the most prominent part of the parietal bone (parietal prominence)

The anterior ascending ramus is directed upwards for Fig 1 8 9 about ¾ inch, whilst the anterior horizontal ramus passes forwards for about the same distance

The pterion corresponds also to the anterior pole of the *insula* and to the *middle cerebral artery* as that vessel lies deeply embedded in the anterior part of the lateral cerebral sulcus

To mark out the *parieto occipital* sulcus and the *superior temporal sulcus* it is necessary to find two bony points—the Fig 1 12-15 marginal tubercle of the zygomatic bone and the lambda A line uniting these two points corresponds in its posterior part to the parieto-occipital sulcus and in its middle third to the superior temporal sulcus

The *central sulcus* (*fissure of Rolando*) —Take a point

above and behind the posterior meningeal point The
Fig II 8 needle should be directed towards the summit of the opposite ear the ventricle being reached within 2 inches from the surface (Keen)

The *basic fossæ*—' There is no external sign to indicate the situation of the fossæ of the skull In general however it may be said that the anterior fossa extends as far back as the anterior end of the zygoma that the middle fossa lies between this and the mastoid process and the posterior includes all the base behind the process (Lisendrath)

The *tympanic antrum* may be exposed by trephining in
Fig II 12a *Macewen s suprameatal triangle* a space which
Fig II 12 is bounded above by the backward continuation of the posterior root of the zygoma (the supramastoid crest) behind by a vertical line drawn upwards from the posterior border of the external auditory meatus and below and in front by the *suprameatal spine* a prominent bony process which assists in the formation of the posterior superior quadrant of the external auditory meatus In this triangle there is usually a well marked depression—the *suprameatal fossa* The supramastoid crest not only indicates the uppermost possible limit of the tympanic antrum but as has already been stated it corresponds also to the level of the base of brain in this situation The crest therefore represents the level of the *tegmen tympani* and in mastoid
Fig II, 13 explorations the field of operation must be confined to an area below this crest In the adult the antrum usually lies at a depth of $\frac{1}{2}$ to $\frac{3}{4}$ inch from the surface In the child it is much nearer the surface

The *transverse venous sinus* lies posterior and nearer to
Fig II, 9 the surface whilst the *facial nerve* pursues its
Fig II 12b course in front and on a deeper plane

The *parotid gland* occupies the space which is bounded above by the zygomatic arch, behind by the auricle and the mastoid process and below by a line drawn from the angle of the jaw to the apex of the mastoid process In front the gland extends a variable distance over the anterior surface of the *masseter* muscle This muscle passes downwards and backwards from the lower border of the zygomatic arch to be attached to the outer surface of the descending ramus and angle of the lower jaw When the teeth are clenched the anterior border of the muscle is easily defined a well marked line of demarcation being so formed between the masseter muscle behind and the buccinator in front

Fig III 2

Parotid (Stenson s) duct the duct of the parotid gland corresponds to the middle third of a line drawn from the lower border of the tragus of the ear to a point situated half way between the ala of the nose and the red line of the upper lip At the anterior border of the masseter muscle the duct dips inwards through the buccinator muscle to open on the buccal mucous membrane opposite the second molar tooth of the upper jaw

Fig III 3

The *transverse facial artery* a branch of the superficial temporal runs forwards parallel to and immediately below the zygoma lying above the level of the parotid duct

Fig III 4

The *facial nerve* after emerging from the stylo mastoid foramen curls round the neck of the mandible and traverses the substance of the parotid gland in which part of its course it divides into numerous branches The general transparotid course of the nerve and the direction of its buccal branch may be indicated by a line drawn forwards parallel to and below the parotid duct from the lobule of the ear

Fig III 5

The *mouth*—In the median line hangs the *uvula* The soft palate traced in the outward direction is seen to diverge into the two *pillars of the fauces*—anterior pillar (palatoglossus) and posterior pillar (palatopharyngeus)—enclosing a triangular recess at the base of which the *tonsil* is situated

The dorsum of the tongue is divided into an anterior two-thirds and a posterior third by a V shaped furrow the *sulcus terminalis* the limbs of which pass obliquely forwards from the foramen cæcum The papillæ of the tongue—*vallate* (8–12 in number immediately anterior to the sulcus terminalis) *fungiform filiform* and *simplex*—are supplied by the lingual branch of the mandibular nerve (ordinary sensibility) chorda tympani (special taste for anterior two thirds) and by branches from the glossopharyngeal to the vallate papillæ (taste)

When the tip of the tongue is turned up the *frenulum* is seen passing in the middle line from tip to base when it meets two lateral irregular folds which correspond to the underlying ducts of the submandibular gland (*Wharton s ducts*) In close proximity to the junction of these mucous folds two papillæ are seen one on either side of the middle line—the openings of the ducts

Running lateral to the frenum but diverging outwards the two *lingual veins* are seen and still more lateral two fringed mucous folds the plica fimbriata On everting the cheek the orifice of the parotid duct will be observed opening opposite the second upper molar tooth

The *teeth* (1) *Deciduous teeth*—When the child is between 2 and 3 years old all deciduous teeth ten in each jaw should be present Though subject to considerable variation they appear at about the following dates

Lower Central incisors	6th month
Upper incisors	9th ,
Lower lateral incisors and 1st molars	15th
Canines	18th
2nd molars	24th

(2) *Permanent teeth* —When complete there are sixteen in each jaw They appear at or about the following dates

1st molars	6th year
Central incisors	7th
Lateral incisors	8th
1st premolars	9th
2nd premolars	10th
Canines	11th
2nd molars	12th
3rd molars	From 17th to 25th year

The Triangles of the Neck

The lateral aspect of the neck is divided by the sternomastoid muscle into two triangles—anterior and posterior

The *anterior triangle* is bounded in front by the middle line of the neck behind by the anterior border of the sternomastoid muscle and above by the lower border of the ramus of the mandible

Fig iv

The space so marked out is divided into three smaller triangles by the digastric muscle and by the anterior belly of the omohyoid

Fig iv 5 (1) The *digastric* triangle above the digastric muscle containing the submandibular gland

Fig iv 11 (2) The *muscular* triangle anterior to the omohyoid muscle bounded by the anterior belly of the omohyoid the anterior border of the sternomastoid and by the median vertical line

(3) The *carotid* triangle bounded above by the posterior belly of the digastric behind by the anterior border of the sternomastoid muscle and in front by the anterior belly of the omohyoid In this triangle the common carotid bifurcates, and the external carotid gives off most of its branches

Fig iv, 10

The *posterior* triangle is bounded in front by the posterior border of the sternomastoid behind by the anterior border of the trapezius and below by the middle third or fourth of the clavicle The triangle is subdivided by the posterior belly of the omohyoid which cuts off the small *supraclavicular* triangle below from the more extensive *occipital* triangle above

Fig iv

The Vessels and Nerves

The *carotid arteries* correspond in direction to a line from the sternoclavicular joint to the hollow between the angle of the mandible and the mastoid process The common carotid usually bifurcates at the level of the upper border of the thyroid cartilage (fourth cervical vertebra) the external carotid subsequently lying superficial to and slightly to the inner side of the internal carotid The *omohyoid* muscle (upper belly) crosses the common carotid at the level of the cricoid cartilage and in this situation the artery may be compressed against the prominent anterior tubercle of the transverse process of the sixth cervical vertebra (Chassaignac s tubercle)

Fig iii, 6

Fig iii 7, 8

The *superior thyroid* artery arises from the external carotid in the carotid triangle immediately above the level of the upper border of the thyroid cartilage and turning downwards under cover of the anterior belly of the omohyoid muscle is directed

Fig iii 11



FIG. III

1 Zygoma
2 Parotid gland
3 Parotid duct (Stenson)
4 Transverse facial artery
5 Facial nerve (buccal branch)
6 Common carotid triangle
7 Internal carotid artery
8 External carotid artery
9 Facial artery
10 Lingual artery
11 Superior thyroid artery
12 Internal jugular vein
13 External jugular vein
14 Subclavian artery
15 Upper limit of brachial plexus

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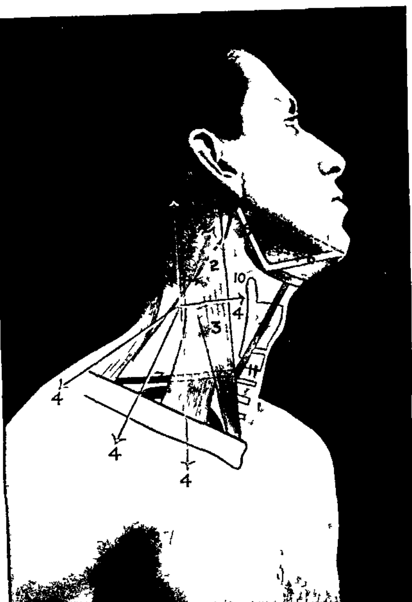


FIG IV

1 Transverse process of the atlas
2 The accessory nerve (spinal accessory)
3 Sternomastoid muscle
4 4 Superficial cervical plexus
5 Digastric triangle
6 6 Anterior and posterior bellies of the digastric muscle
7 7 Anterior and posterior bellies of the omohyoid muscle
8 8 Supraclavicular triangle
9 Posterior triangle
10 Carotid triangle
11 Muscular triangle

T f F g III pp 4 5

towards the apex of the lateral lobe of the thyroid gland

The *lingual artery* arises midway between the level of the upper border of the thyroid cartilage and the great cornu of the hyoid bone and enters the digastric triangle by passing deep to the digastric muscle The artery so gains the upper border of the hyoid bone and runs inwards for a short distance parallel to that bone under cover of the hyoglossus muscle

Fig III 10

The *facial artery* arises opposite the great cornu of the hyoid bone and enters the digastric triangle by passing deep to the tendon of the digastric In this triangle the artery lies deeply embedded in the substance of the submandibular salivary gland and then enters on its facial course by curling round the inferior border of the mandible immediately anterior to the masseter muscle about 1¼ inches in front of the angle of the mandible The vessel then passes upwards towards the inner canthus of the eye there terminating as the angular artery

Fig III 9

The *occipital artery* arises from the posterior part of the external carotid artery in the upper part of the carotid triangle and passes upwards and backwards under cover of the posterior belly of the digastric muscle towards the interval between the mastoid process and the transverse process of the atlas At the apex of the posterior triangle the artery is joined by the greater occipital nerve (posterior primary ramus of the second cervical nerve) the two structures then passing upwards on to the vault of the skull

The *posterior auricular artery* arises from the external carotid immediately above the posterior belly of the

below and in front of the apex of the mastoid process The nerve enters the substance of the sternomastoid at the junction of the upper and second quarters along Fig iv, 2 the anterior border of the muscle emerging from the posterior border of the muscle at the junction of the upper and middle thirds The point of emergence is however subject to some variation, and the nerve may enter the posterior triangle of the neck at a somewhat lower level pursuing subsequently a downward and backward course towards the anterior border of the trapezius muscle beneath which muscle it sinks *

The *superficial cervical plexus* —Take a point midway Fig iv, 4 along the posterior border of the sternomastoid muscle, and from this point draw three lines

1 Upwards towards the lobe of the ear = the great auricular nerve (2 and 3 C)

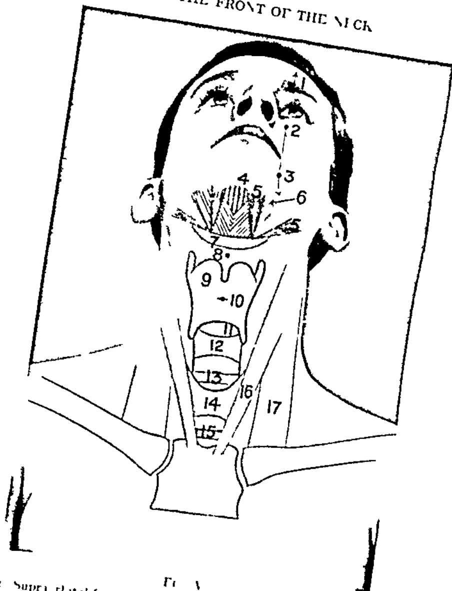
2 Upwards along the posterior border of the sternomastoid muscle = lesser occipital nerve (2 C)

3 Forwards towards the middle line of the neck = the anterior cutaneous nerve (2 and 3 C)

These three lines produced downwards represent the direction of the descending branches of the plexus Thus the great auricular produced = the intermediate supraclavicular nerve the anterior cutaneous = the lateral supraclavicular nerve and the lesser occipital = the medial supraclavicular nerve These three descending branches are derived from the 3rd and 4th cervical nerves

* Another surface marking for the *spinal accessory nerve* — Draw a line from a point midway between the tip of the mastoid process and the angle of the mandible to the middle of the posterior border of the sternomastoid muscle and thence across the posterior triangle to the anterior border of trapezius

THE FRONT OF THE NECK



Fi[illegible]

1 Supraorbital foramen
2 Infraorbital foramen
3 Mental foramen
4 Geniohyoid muscle
5 5 Anterior and posterior bellies of the digastric muscle
6 Mylohyoid muscle
7 Hyoid bone
8 Thyrohyoid membrane and epiglottis
9 Thyroid cartilage
10 Rima glottidis
11 Cricothyroid ligament and cricovocal membrane
12 Cricoid cartilage
13 First ring of trachea
14 Isthmus of the thyroid gland
15 Tracheal ring
16 Sternal head of sterno-mastoid muscle
17 Clavicular head of sterno-mastoid

T face p [illegible]

The *brachial plexus* —The upper limit of the nerve
Fig iii 15 trunks which form this plexus is represented by a line drawn from the mid point between the anterior and posterior borders of the sternomastoid muscle at the level of the cricoid cartilage to a second point situated just external to the mid point of the clavicle The lowest cord lies behind the third part of the subclavian artery

The *rima glottidis* bounded laterally by the true
Fig v 10 vocal cords lies opposite the mid point along the anterior border of the thyroid cartilage

The *epiglottis* though fixed below to the thyroid angle
Fig v 8 immediately above the point of attachment of the true vocal cords extends upwards to above the level of the body of the hyoid bone

A suicidal cut throat frequently involves the thyro hyoid membrane and the epiglottis may be severed from its thyroid attachment

The *isthmus of the thyroid gland* crosses the trachea
Fig v 14 about ¼ to ¾ inch below the cricoid cartilage The *lateral lobes* extend upwards to the middle of the thyroid cartilage downwards nearly to the clavicle and outwards to be overlapped by the sternomastoid muscle

Fig v *The structures in the middle line of the neck*

(1) Passing down from the mandible to the body of the hyoid bone the two geniohyoid muscles lie each side of the middle line (2) The body of the hyoid bone (3) The thyrohyoid membrane (4) The thyroid cartilage (5) The cricothyroid ligament and cricovocal membrane (6) The cricoid cartilage (7) The first ring of the trachea (8) The isthmus of the thyroid gland (9) The trachea (10) The suprasternal notch

CHAPTER II

THE UPPER LIMB

IN this chapter and in that on the lower extremity, the reader's attention is directed mainly to those bony prominences and muscular or tendinous elevations which lie in the region of the joints since these form the more important landmarks which aid in the representation of the arteries nerves, etc, of the limbs The muscular masses which complete the symmetry of the arm or leg between the joints are only mentioned where necessary a fair general knowledge of the anatomical structure of the body being assumed

The *Shoulder region*—The acromion the spine of the scapula and the clavicle being subcutaneous throughout their whole length can readily be palpated from end to end The clavicle should be examined first from its blunted sternal extremity to the acromio-clavicular joint The inner third of the shaft is rounded and presents a marked forward convexity whilst the outer third of the bone is flattened from before backwards and shows a concave anterior border *At the outer end* of the bone a slight elevation may be felt on the superior surface and immediately external to this is the acromio-clavicular joint the long axis of which lies in the antero-posterior direction

The acromial spine is narrow at about its centre broadening out towards the vertebral border of the scapula and forming there a smooth triangular surface over which glides the tendinous part of the trapezius Laterally the spine terminates in the upward curved
Fig xiii acromial process at the anterior border of
1 which an oval facet is situated for articulation with the clavicle The supra- and infraspinatus muscles fill up the depressions or fossæ which lie above and below the spine of the acromion

The clavicle is also bounded above and below by depressions little evident in fat subjects but most marked when as the result of pathological or physiological conditions fat is feebly represented The supraclavicular or subclavian triangle is dealt with in the first chapter The *infraclavicular space* is bounded above by the clavicle below by the clavicular head of the pectoralis major muscle medially by the costal cartilage of the first rib and laterally by the anterior border of the deltoid muscle The floor is formed by the subclavius muscle and the clavi pectoral fascia In the outer part of the space the coracoid process may be felt lying under cover of the anterior border of the deltoid muscle 1 inch below the
Fig xiii junction of the outer and middle thirds of the clavicle The bulky deltoid muscle arising from the clavicle and from the acromion and the spine of the scapula is so to speak pushed outwards by the underlying head and greater tuberosity of the humerus so producing the normal rounded appearance of the shoulder This outward displacement of the muscle is taken advantage of by Hamilton in the diagnosis of a dislocation of the shoulder joint as after such an injury the humerus is drawn inwards by the pectoralis major latissimus dorsi

and other muscles to such a degree that a ruler placed along the outer side of the arm will be in contact with the acromion and the lateral epicondyle of the humerus at one and the same time In the normal condition this is not possible

To measure the *length of the humerus* the tape measure should be carried from the lower margin of the acromion to the lateral epicondyle of the humerus

Fig xiii 1-2

Between the greater and lesser tuberosities of the humerus is the *bicipital groove*, in which runs the long tendon of the biceps muscle The groove may be represented by a line, about 2 inches long, which runs downwards from the tip of the acromion parallel to the long axis of the humerus

The *upper epiphysis* of the humerus includes the head and both tuberosities, and the epiphysial line runs transversely, at right angles to the long axis of the humerus at the lower border of the great tuberosity

The axilla—*To examine this space the elbow should* be supported and the patient instructed to relax all muscles The anterior wall is formed by the major and minor pectoral muscles and by the clavi pectoral fascia The pectoralis major alone forms the anterior fold of the axilla and does not extend as far downwards as the posterior fold whilst its rounded appearance results from the twisting of the fibres of the muscle previous to insertion into the outer bicipital ridge The posterior wall is formed by the latissimus dorsi teres major and subscapularis muscles The rounding of the posterior fold of the axilla is due to the latissimus dorsi which curls round the teres major muscle from behind forwards in order to reach its insertion into the floor

Fig vi, 3

THE FRONT OF THE ARM AND FOREARM

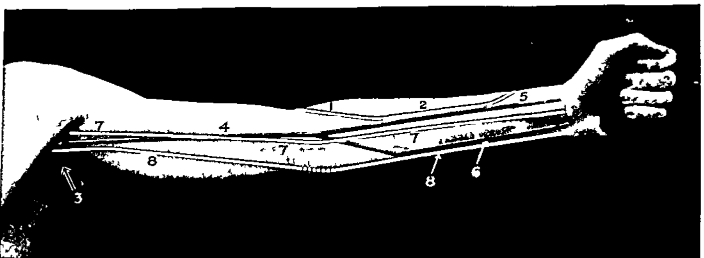


Fig VI

1, 2 The radial nerve
3 The axilla
4 Brachial artery
5 Radial artery
6 Ulnar artery
7 7 Median nerve
8 8 Ulnar nerve

To face p 22

Fig. VII

THE BACK

6a. The termination of the ... at the level of the 3rd sacral vertebra ... line drawn ... between the two posterior ...

The ... terminale

a. The termination of the ... the tip of the coccyx

8. ... pyloric plane

9. The ... tubercular plane (highest point of iliac crest)

10. The site for lumbar puncture

11. The iliac crests.

of the bicipital groove The narrow outer boundary of the axilla corresponds to the upper part of the shaft and to the head of the humerus and in this situation in a well-developed arm, two prominent longitudinal folds are seen the anterior of which corresponds to the coraco brachialis and biceps (short head) muscles whilst the more posterior fold results from the projection of the neuro-vascular bundle The head of the humerus and of the scapula can be felt at the upper and posterior part of the axilla the second rib on the inner side and the cora coid process in front The head of the humerus looks in the same direction as the medial epicondyle of the humerus The inner wall of the axilla is formed by the upper part of the lateral wall of the thorax which is here clothed by the serrations of the serratus anterior muscle

The *axillary lymphatic glands* are arranged in three main groups all converging towards the apex of the axilla

(*a*) The *pectoral* set running upwards and outwards under cover of the outer border of the pectoral muscles and draining the anterior and lateral aspects of the chest wall and the abdomen above the level of the umbilicus

(*b*) The *subscapular* set running upwards along the axillary border of the subscapularis muscle and draining the lateral and posterior aspect of the chest above the level of the umbilicus

(*c*) The *brachial and axillary* set running upwards in the line of the axillary vessels and draining the whole of the upper limb

The *Elbow region* —When the forearm is extended a line joining the medial and lateral epicondyles of the humerus cuts across the tip of the olecranon process which bony prominence lies well to the medial side of the mid point of the intercondyloid line

Fig vii 1-3

When the forearm is flexed the olecranon moves down-wards and by uniting the three bony points a triangle is formed Immediately below the lateral epicondyle the head of the radius is felt "lying in the valley behind the brachioradialis (Holden) The humero radial articulation is transverse but the humero ulnar articulation slopes obliquely downwards and inwards and consequently whilst the lateral epicondyle is about ¾ inch above the humero radial joint the medial epicondyle lies rather more than 1 inch above the line of the humero-ulnar articulation

Fig VII 4

The junction of the *diaphysis* and *lower epiphysis* of the humerus corresponds to a transverse line drawn across the humerus immediately above the tips of the epicondyles The bony points on the outer side of the joint are generally obscured in those cases where there is considerable effusion into the elbow joint, the synovial membrane bulging outwards below the lateral epicondyle of the humerus and between that process and the olecranon process Under similar conditions there is also an outward projection of the synovial membrane between the olecranon and the medial epicondyle of the humerus obscuring the deep depression that normally exists in that situation—a depression at the base of which the ulnar nerve can be rolled beneath the finger

In front of the elbow is the *cubital fossa* a triangular space the base of which corresponds to a line drawn across the front of the elbow between the two humeral epicondyles whilst the inner and outer boundaries are formed respectively by the pronator teres and brachioradialis muscles This triangular space is vertically subdivided by the biceps tendon on either side of which a depres-

Fig VIII 1, 1

Fig VIII 4 5

Fig VIII 2

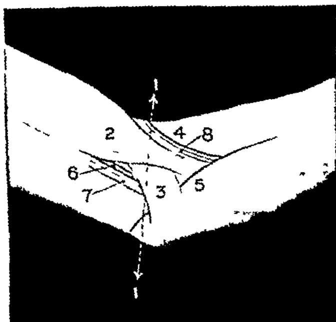


FIG. VIII

1 The inter-condyloid line
2 Biceps muscle
3 Bicipital aponeurosis
4 Brachioradialis
5 Pronator radii teres
6 Brachial artery
7 Median nerve
8 Radial nerve

To face p.

sion exists—the inner and outer *bicipital sulci* In the outer sulcus the radial nerve gives origin to its posterior interosseous branch and is then continued as a pure sensory nerve The median nerve and the brachial artery lie in the inner sulcus, the artery intermediate between the tendon and the nerve The artery and nerve are however obscured in the lower part of the inner sulcus by the overlying *bicipital aponeurosis* which can be traced inwards to the pronator region whilst its upper free margin presents a well marked crescentic edge which looks upwards and inwards This aponeurosis becomes well defined on forcible flexion of the elbow

Fig viii, 8

Fig viii 6 7

Fig viii 3

The *superficial veins* in front of the bend of the elbow are arranged in the form of a letter M the radial median and ulnar group of veins being received from below whilst the two main efferent vessels, the cephalic and the basilic carry the blood upwards The *basilic vein* passes upwards in the superficial fascia along the inner side of the arm and pierces the deep fascia about half way between the axilla and the medial epicondyle, and at the foramen so produced in the deep fascia the medial antebrachial cutaneous nerve emerges to become superficial The *epitrochlear gland* lies in close connection with the median basilic or basilic veins above and in front of the internal condyle

Fig ix

Fig ix 6

The *cephalic vein* can be traced upwards along the outer side of the arm as far as the groove between the deltoid and pectoralis major muscles In the interval between these two muscles the vein lies embedded and eventually pierces the clavipectoral fascia in the infraclavicular region to open into the axillary vein

Fig ix 7

Fig ix, 7

The Region of the Wrist and Hand

Two tendons only are conspicuous at the front of the
Fig x 2, 3 wrist—the palmaris longus in the middle line
and the flexor carpi radialis to the outer side
of the palmaris longus The flexor carpi ulnaris can
however, be distinguished by palpation along the ulnar
Fig x, 5, 6 border of the forearm and can be traced downwards to its insertion into the pisiform bone
Between the palmaris longus and the flexor carpi ulnaris
the main mass of the flexor digitorum sublimis lies Two
Fig x, 7 transverse creases are seen in this situation the
upper of which corresponds roughly to the level
of the radiocarpal joint, while the lower represents almost
exactly the upper limit of the flexor retinaculum
(transverse carpal ligament)

Just lateral to where the flexor carpi radialis tendon
cuts across the two transverse creases there is a depression in the floor of which the lower end of the radius
and the tubercle of the scaphoid bone may be felt
The radial artery crosses this space in a downward and
Fig x, 1 outward direction The trapezium lies at the
lower limit of the depression immediately
below and external to the scaphoid tuberosity The
prominent pisiform bone can be distinguished by
Fig x, 5, 6 tracing downwards the tendon of the flexor
carpi ulnaris muscle and posterior to this bone
both triquetral and hamate bones are situated A finger's
Fig xi 5 breadth below and lateral to the pisiform
bone deep palpation will verify the position of
the hook of the hamate bone

The *flexor retinaculum* is attached to four bony
Fig xi 1 points two on the radial side the scaphoid
tubercle and the ridge on the trapezium and

THE PALM OF THE HAND

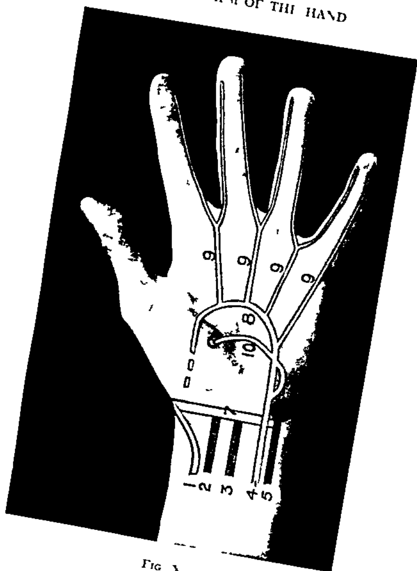


Fig. X

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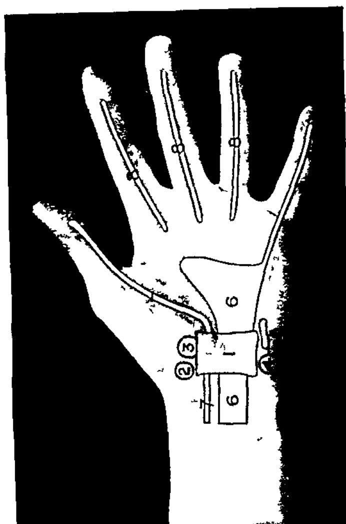


FIG XI

1 The flexor retinaculum
2 Scaphoid tubercle
3 Ridge of trapezium
4 Pisiform bone
5 Hook of hamate
6 Common flexor synovial sheath
7 Flexor pollicis longus sheath
8 8 Distal flexor sheaths

To follow Fig X

FIG X

1 Radial artery
2 Flexor carpi radialis
3 Palmaris longus
4 Ulnar artery
5 Flexor carpi ulnaris
6 The pisiform bone
7 The two transverse creases in front of the joint
8 The superficial branch of the ulnar artery forming with the superficial palmar branch of the radial artery the superficial palmar arch
9 9 The digital branches of the superficial palmar arch
10 The deep branch of the ulnar forming the deep palmar arch passing between the two heads of the first dorsal interosseous muscle to join the radial

two on the ulnar side the pisiform and the hook of the hamate The upper limit of the ligament corresponds to the lower of the two transverse creases in front of the wrist whilst the inferior limit of the ligament lies about ¾ inch below

The *flexor synovial sheaths* —The flexor pollicis longus, the flexor digitorum sublimis and profundus all pass beneath the flexor retinaculum In this situation the flexor sublimis consists of four tendons of which the medius and annularis lie superficial to the tendons which pass to the index and little fingers The profundus consists of two parts only the tendon to the index finger being alone differentiated off from the main mass Beneath the ligament these tendons are surrounded by two synovial sheaths one for the flexor pollicis longus and one for the remaining tendons plus the median nerve These sheaths extend upwards about 1 inch above the upper limit of the ligament and therefore the same distance above the lower transverse crease in front of the wrist The flexor pollicis longus sheath is continued downwards to the insertion of the tendon into the distal phalanx of the thumb The main sheath broadens out below the ligament and though generally continued onwards to the end of the little finger the major portion terminates at the level of the upper transverse crease of the palm The flexor tendons to the index middle and ring fingers also possess more distally distinct synovial sheaths which extend from the terminal phalanges of the fingers upwards to the necks of the metacarpal bones a level corresponding roughly to the lower transverse crease of the palm

Fig xi

Fig xi 6 6

Fig xi

A distance of ½ inch separates the main synovial sheath above from the more distal segments below

On the lateral side of the wrist the most marked feature is the "anatomical snuff box"—a space bounded on the radial side by the tendons of the abductor pollicis longus and extensor pollicis brevis muscles, and on the ulnar side by the tendon of the extensor pollicis longus.

In the floor of the space the styloid process of the radius is felt, this prominence lying fully ½ inch below the level of the corresponding process of the ulna and also on a slightly more anterior plane. Immediately below the radial styloid process the scaphoid bone lies most prominent when the *hand is well adducted*. *Below this again the trapezium and the bases of the first and second* metacarpals are to be felt.

On the dorsum of the hand there is a well marked elevation, most noticeable when the wrist is fully flexed, due to the projection of the bases of the second and third *metacarpal bones, the styloid process of the latter bone* being especially prominent.

Immediately above this elevation there is a depression *where the tendons of the extensor carpi radialis longus* and brevis are felt as they pass to their insertion into the bases of the second and third metacarpal bones.

Near the middle of the posterior aspect of the lower end of the radius a tubercle can generally be dis-
Fig. xii. 4. tinguished—*the dorsal tubercle (Lister)*—separating the extensor pollicis longus on the medial side from the tendon of the extensor carpi radialis brevis, which lies more lateral.

The *extensor retinaculum ligament* is represented by an oblique band about 1 inch broad, which
Fig. xii. 1. extends from the lower part of the outer border of the radius to the styloid process of the ulna and the carpal bones below the ulna. The ligament has

THE BACK OF THE WRIST

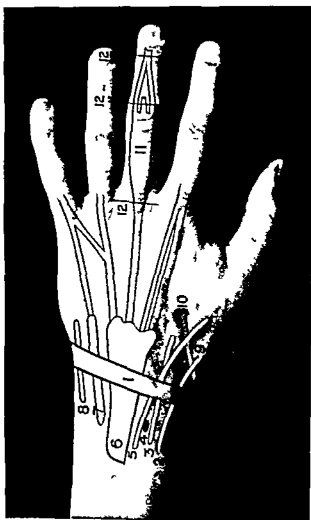


FIG XII

To fac p 28

FIG XII

1 The extensor retinaculum

2 Synovial sheath for the abductor and extensor pollicis brevis tendons

3 Sheath for the extensor carpi radialis longus and brevis tendons

4 Dorsal tubercle

5 Sheath for extensor pollicis longus tendons

6 Sheath for extensor digitorum and indicis tendon

7 Sheath for extensor digiti minimi

8 Sheath for extensor carpi ulnaris

9 Radial artery cutting across the anatomical snuff box

10 Radial artery dipping down between the two heads of the first dorsal interosseous muscle

11 The method of insertion of an extensor tendon to the bases of the middle and distal phalanges

12 Transverse lines corresponding to the levels of the metacarpo-phalangeal and inter phalangeal joints

therefore a downward and inward direction and beneath it pass the extensor tendons These occupy distinct compartments and possess synovial sheaths as under

1 One compartment and synovial sheath for the
Fig xii 2 abductor pollicis and extensor pollicis brevis

Fig xii 3 2 One for the extensor carpi radialis longus and brevis

Fig xii 5 3 One for the extensor pollicis longus

Fig xii 6 4 One for the extensor (communis) digitorum and extensor indicis

Fig xii 7 5 One for the extensor digiti minimi

Fig xii 8 6 One for the extensor carpi ulnaris

The extent of the synovial sheaths is indicated in the diagram where the radial artery is also depicted as it
Fig xii 9, 10 crosses the anatomical snuff box towards the base of the first interosseous space at which level the vessel dips down between the two heads of the first dorsal interosseous muscle to complete the deep palmar arch

The bony prominence on the medial aspect of the dorsum of the lower end of the ulna alters with pronation and supination of the forearm In pronation this prominence is formed by the head of the ulna while in supination the prominence is formed by the styloid process of the ulna

Vessels etc of the Upper Limb

The *axillary artery* extends from the outer border of the first rib to the lower margin of the teres major muscle When the arm is held out at right angles to the long axis of the body and the palmar surface of the hand turned

upwards the artery corresponds in direction to a line drawn from the middle of the clavicle to the junction of the anterior and middle thirds of the outer axillary wall at the outlet of that space At its termination the artery and the accompanying nerves—the neuro-vascular bundle—form a projection which lies behind that due to the coracobrachialis and biceps (short head) muscles The artery is divided into three parts by the pectoralis minor muscle which muscle can be represented by a triangle the base corresponding to the anterior extremities of the third, fourth and fifth ribs, whilst the apex is situated at the end of the coracoid process

Fig vi, 4

The *brachial artery* —The arm and forearm being held in the position already indicated as necessary in order to map out the axillary artery the brachial artery corresponds to a line drawn from the outer wall of the axillary outlet at the junction of its anterior and middle thirds to the mid point in front of the bend of the elbow at the level of the head of the radius At the last point the artery bifurcates into radial and ulnar arteries

Fig vi 5

The *radial artery* extends from the middle of the bend of the elbow at the level of the head of the radius to the radial side of the tendon of the flexor carpi radialis muscle just above the base of the thumb The artery then crosses the anatomical snuff box towards the base of the first interosseous space

Fig vi 6

The *ulnar artery* in the lower two thirds of its course accompanies and lies to the lateral side of the ulnar nerve The upper third of its course is represented by a line which passes obliquely upwards and outwards to the middle of the bend of the elbow at the level of the head of the radius

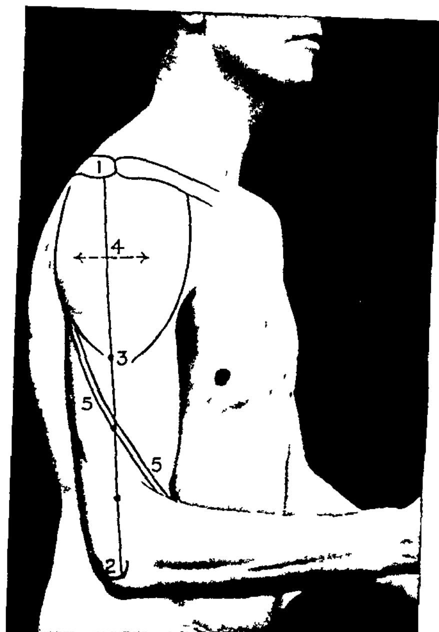


FIG. XIII

1 The acromion

The lateral epicondyle of the humerus. (Between these two points the length of the humerus may be measured.)

3 The insertion of the deltoid muscle

4 The mid point of the deltoid corresponding to the position of the circumflex nerve and circumflex arteries

5 5 The radial nerve

To face p. 51

The *superficial palmar arch* is formed by the anastomosis of the superficial division of the ulnar artery with the superficial palmar branch or some other branch of the radial artery The convexity of the arch looks towards the fingers and lies on a level with the lower border of the outstretched thumb Occasionally the arch extends lower down, reaching as far as the upper of the two transverse creases on the palmar aspect of the hand

Fig x, 8

The *deep palmar arch* formed by the anastomosis of the radial artery with the deep branch of the ulnar, lies about one finger s breadth proximal to the level of the superficial palmar arch

Fig x 10

The *digital branches* of the superficial palmar arch pass downwards in the intervals between the metacarpal bones to within ½ inch of the digital clefts where the vessels bifurcate to run along the adjacent sides of the fingers

Fig x 9

The digital nerves bifurcate proximally to the deep transverse metacarpal ligament whereas the arteries divide distally

The *circumflex nerve and the posterior circumflex artery* pass backwards through the quadrilateral space (teres minor and subscapularis above teres major below long head of triceps medially and humerus laterally) and curl round the surgical neck of the humerus towards the outer and anterior aspect of the shoulder region The artery anastomoses with the anterior circumflex artery and the level of the arterial circle so formed and of the *circumflex nerve* may be represented by a line drawn at right angles to the shaft of the humerus from a point just above the centre of the deltoid muscle

Fig xiii 4

The *musculo cutaneous nerve* usually pierces the inner

aspect of the coracobrachialis muscle about 1 to 2 inches below the coracoid process It then runs downwards and outwards, deep to the biceps muscle towards the outer bicipital sulcus, at which level it becomes cutaneous The course of the nerve in the arm can therefore be roughly indicated by a line from the coracoid process above to the outer bicipital sulcus below

The *radial nerve* accompanied by the anterior branch of the profunda brachii artery pierces the lateral intermuscular septum of the arm from behind forwards

Fig xiii 5 at the junction of the upper and middle thirds of a line drawn from the insertion of the deltoid muscle to the lateral epicondyle of the humerus Below this point the nerve passes downwards and inwards to the outer bicipital sulcus where it gives origin to its posterior interosseous branch Above the point at which the nerve pierces the lateral intermuscular septum its course may be represented by a curved line drawn upwards and inwards to the junction of the upper arm with the posterior fold of the axilla

From the outer bicipital sulcus the *radial nerve* is con

Fig vi 2 tinued down the forearm accompanying and lying to the outer side of the radial artery in its middle third At the junction of the middle and lower thirds of the forearm the nerve turns round the outer border of the radius under cover of the brachioradialis tendon to be distributed to the back of the wrist and hand

The *posterior interosseous* nerve is given off from the radial in the outer bicipital sulcus and curls round the neck of the radius in the substance of the supinator muscle emerging from the posterior border of that muscle 2 inches below the head of the radius It then passes down the posterior aspect of the forearm lying

about midway between the inner and outer borders and terminating in a gangliform enlargement at the posterior aspect of the wrist

The *median nerve in the arm* —This nerve accompanies the brachial artery and therefore presents a
Fig vi 7 similar surface marking It is necessary however to bear in mind that the nerve crosses the artery superficially from above downwards and from without inwards

The *median nerve* in the forearm passes downwards from the inner bicipital sulcus to the front of
Fig vi 7 the wrist there lying to the medial side of the flexor carpi radialis and under cover of the palmaris longus tendon The nerve then passes under the flexor retinaculum to the palm

The *ulnar nerve* in the upper third of the arm lies along the inner side of the brachial artery It then
Fig vi 8 leaves that vessel and accompanied by the ulnar collateral artery passes downwards and backwards to reach the hollow between the medial epicondyle and the olecranon process

The *ulnar nerve* in the forearm corresponds in direction to a line drawn from the medial epicondyle of
Fig vi 8 the humerus to the medial side of the pisiform bone In front of the wrist the nerve lies to the medial side of the tendon of the flexor carpi ulnaris muscle and subsequently passes superficial to the flexor retinaculum protected by the volar carpal ligament to its palmar distribution

The *palmar fascia* is triangular in shape the apex attached to the flexor retinaculum between the thenar and hypothenar eminences whilst the base corresponds to the proximal ends of the four fingers

The Creases of the Palm and Fingers

The proximal transverse crease on the palmar aspect of the hand lies just below the normal limit of the superficial palmar arch but at the level of the lower limit of the main flexor synovial sheath The distal crease crosses the necks of the metacarpal bones and corresponds to the proximal limit of the distal flexor synovial sheaths

The metacarpo phalangeal joints lie about half way between the distal crease of the palm and the proximal crease of the fingers The middle and distal creases on the palmar aspect of the fingers correspond fairly accurately to the respective interphalangeal joints The knuckles are formed by the *heads* of metacarpal bones

CHAPTER III

THE THORAX

THE majority of the thoracic viscera are depicted on the surface in relation to the costal cartilages ribs and inter costal spaces and it is therefore necessary to lay stress on certain important points

1 That the twelve ribs are divided into two groups (*a*) *True* ribs seven in number articulating by means of their costal cartilages with the sterno xiphoid bone (*b*) *False* ribs five in number all falling short of the middle line the upper three attached to the costal cartilage of the rib above the lower two *not* articulating with the transverse process of the corresponding vertebra and the anterior extremities *not* attached to the costal cartilage of the rib above These last two ribs are therefore known as floating ribs

2 That the 1st rib lies mainly under cover of the clavicle but that its costal cartilage can generally be palpated with ease as it lies below the sternal end of the clavicle

3 That the 1*st* interspace which can be felt to the outer side of the sternum *is* the 1*st* interspace This axiom may appear at first sight to be quite unnecessary but it is in reality not uncommon for students to regard the first space which can be felt as the second interspace

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CHAPTFR III

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the *ventricular* area below and to the left This ventricular
Fig xiv, 6 area is occupied mainly by the right ventricle, whilst a narrow strip along the left border
Fig xiv, 7 represents that part of the left ventricle which comes to the surface

The four points given above for marking out the projection of the heart on the anterior thoracic wall may be simplified by taking and joining the following four points

1 The upper border of the 3rd *right chondro-sternal* joint

2 The lower border of the *2nd left chondro-sternal* joint

3 The lower border of the 6th right chondro-sternal joint

4 The position of the apex beat

By uniting these four points the heart is mapped out for most practical purposes with sufficient accuracy

THE VALVES OF THE HEART

1 The *pulmonary* valve is situated at the highest level
Fig xiv 9 and lies opposite the upper border of the 3rd left costal cartilage close to its junction with the sternum

2 The *aortic* valve lies just below and medial to the
Fig xiv, 11 pulmonary valve at the lower border of the 3rd left costal cartilage at its junction with the sternum

3 The *mitral* or left auriculo-ventricular valve is situ-
Fig xiv 12 ated behind the left half of the sternum at the level of the 4th chondro-sternal joint

4 The *tricuspid* or right auriculo-ventricular valve lies
Fig xiv 13 very obliquely behind the sternum at the level of the 4th interspace and the anterior extrem

THE HEART, GREAT VESSELS, KIDNEY, AND URETER

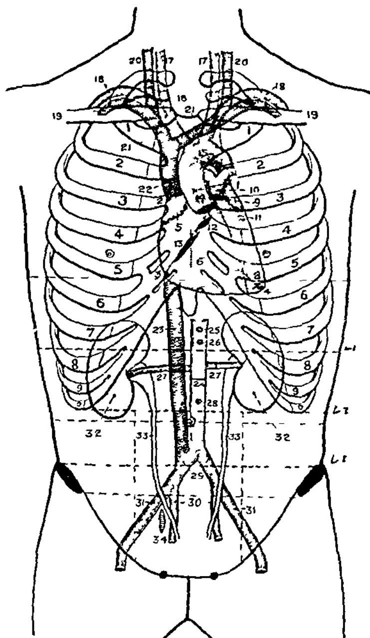


FIG XIV

T fac p 38

ities of the 5th costal cartilages extending downwards and to the right almost as far as the 6th chondro-sternal joint

The Aorta and other Vessels etc

The *ascending aorta* 2 to $2\frac{1}{2}$ inches long arises behind the left border of the sternum at the level of the 3rd costal cartilage and passes upwards and to the right towards the right border of the sternum at the level of the 2nd costal cartilage

Fig xiv, 14

The *aortic arch* is directed backwards and to the left the upper limit lying about 1 inch below the suprasternal notch or half way between that notch and the angle of Louis (junction of manubrium and body of sternum) The arch becomes the descending aorta at the left side of the lower part of the body of the 4th thoracic vertebra

Fig xiv 15

The *descending thoracic aorta* 7 to 8 inches long passes onwards through the posterior mediastinum and pierces the diaphragm at the level of the 12th dorsal vertebra The site of diaphragmatic perforation is represented on the surface by a point situated just to the left of the middle line two fingers breadth above the transpyloric plane *

The *innominate artery* $1\frac{1}{2}$ to 2 inches long arises from the aortic arch in the middle line 1 inch below the suprasternal notch and passes upwards and to the right to the right sternoclavicular joint at which level it bifurcates into its two terminal branches

Fig xiv 16

The *left common carotid* (thoracic course) arises from the aortic arch on a posterior plane to and slightly to the left of the trunk of the innominate artery and passes upwards and to the left to the left sternoclavicular joint

Fig xiv, 17

* Any planes mentioned in this chapter will be explained in the chapter on the abdomen

The *left subclavian artery* (thoracic course) arises from
Fig xiv 18 the aortic arch on a posterior plane to and slightly to the left of the thoracic part of the left common carotid artery and passes almost vertically upwards behind the left border of the sternum to the left sternoclavicular joint

The *superior mediastinum* is bounded above by the plane
Fig xvii of the thoracic inlet and below by a plane which passes backwards from the sternal angle in front to the lower border of the 4th thoracic vertebra (Louis plane)

The *pulmonary artery* arises opposite the upper border
Fig xiv, 10 of the 3rd left costal cartilage at its junction with the sternum, and passes backwards and slightly upwards to its bifurcation which takes place opposite the 2nd left costal cartilage

The *internal mammary artery* arises from the first part
Fig xx, 8 of the cervical course of the subclavian artery, and passes almost vertically downwards behind the corresponding sternoclavicular joint In its further thoracic course, the artery lies ½ inch lateral to the outer border of the sternum, bifurcating opposite the
Fig xx 9 10 6th costal cartilage or the 6th interspace into the *musculophrenic* and *superior epigastric* arteries The former vessel curves outwards, following the line of the costal arch whilst the latter passes onwards to enter the sheath of the rectus abdominis muscle

The *left innominate vein* 3 inches long is formed opposite the left sternoclavicular joint, and passes to the right slightly overlapping the upper part of the aortic
Fig xiv, 21 arch and occupying the greater part of the space between the summit of the arch below and the suprasternal notch above

The *right innominate vein* is formed at the right sterno-
Fig xiv 21 clavicular joint and passes obliquely down wards and inwards to meet the corresponding vein of the opposite side at the lower border of the 1st right costal cartilage close to its junction with the sternum

The *superior vena cava* formed by the junction of the
Fig xiv, 22 above two veins is directed almost vertically downwards from the lower border of the 1st right costal cartilage close to its junction with the sternum to open into the right auricle of the heart at the level of the upper border of the 3rd right chondro sternal junction

The *inferior vena cava* enters upon its short intra
Fig xiv 23 thoracic course by passing through the venacaval or quadrate tendinous opening of the diaphragm at the level of the 8th thoracic vertebra opening into the right auricle of the heart opposite the 5th right interspace and the adjoining part of the sternum

The *vena azygos* drains the whole thoracic wall except the first space on the right side and the upper three spaces on the left It opens into the superior vena cava at the level of the lower part of the 2nd right interspace curling round the root of the right lung in order to reach its destination

The main *aortic intercostal* vessels occupy the costal groove of a rib as they pass round the chest wall lying between the corresponding vein above and the nerve below

THE PLEURA AND LUNGS

1 The *pleural sacs* —When the shoulders are depressed
Fig xv 5 Fig xvi 4 the two clavicles lie practically at right angles to the long axis of the body and in this

position the apices of the pleural sacs extend into the supraclavicular region, lying about 1½ inches above the clavicle under cover of the clavicular head of the sterno-mastoid muscle

The anterior margin of each sac sweeps downwards and inwards behind the *corresponding sternoclavicular joint*, the two sacs converging towards the sternal angle (junction of manubrium and body of sternum) at which level they *meet one another just to the left of the middle line* They *then pass* vertically *downwards parallel to one another* as *far as the* level *of the 4th chondro-sternal junction*

The right sac passes onwards in the same straight line to the 6th or 7th chondro-sternal joint, and then sweeps round the anterior, lateral and posterior aspects of the chest wall cutting across—

(1) The *upper* part of the 8th *costal cartilage* in the lateral vertical line

(2) *The 10th rib in the mid axillary line*

(3) The 11th rib in the line of the *inferior angle* of the scapula

(4) The 12th rib at the outer *border* of the sacro-spinalis muscle

The obliquity of the 12th rib causes the pleura to fall below the level of the inner half of the rib, the pleura *in this last part of its* course being directed inwards towards the spine of the 12th dorsal vertebra

The *left pleura* from the level of the 4th left *chondro* sternal joint, sweeps obliquely outwards and downwards behind the costal cartilages of the 5th 6th and 7th ribs to the 8th costal cartilage in the lateral vertical plane Beyond this point the left pleura follows the same general direction as the *right* sac, *descending* however to a slightly lower level

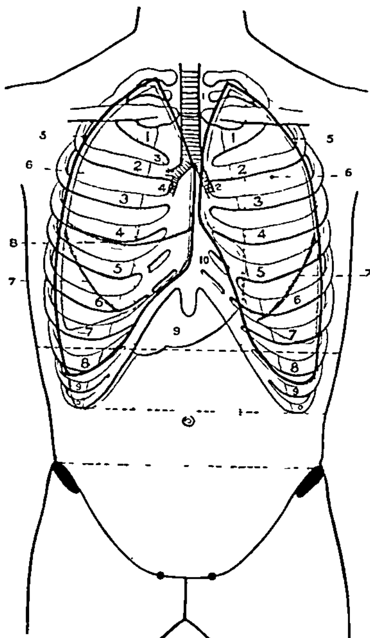


Fig XV

1 The trachea
2 The left bronchus
3 The eparterial bronchus
4 The hyparterial bronchus
5 The pleuræ
6 The lungs
7 7 The main oblique fissure of the lungs
8 The small transverse fissure of the right lung
9 The liver
10 Area of superficial

The lowest limit reached by the two pleural sacs is situated in the mid axillary line the sacs there cutting across the 10th rib about 2 inches above the costal margin which is in this situation usually represented by the tip of the 11th rib

Difficulty is sometimes experienced in endeavouring to verify the position of the 12th thoracic spine and in such cases the pleural reflection behind the mid axillary region may be represented by a line which passes almost transversely backwards towards the middle line of the back from the 10th rib in the mid axillary line

The two sacs are for the most part separated from one another by the width of the vertebral bodies—about 1½ inches In the lower part of the posterior mediastinum however the right sac approaches the middle line

Fig xvi 4

2 The *lungs* may be mapped out in part by lines similar to those given for the pleural sacs The apex of the upper lobe of each lung extends into the supraclavicular region and the anterior margins converge towards the sternal angle cutting obliquely across the corresponding sternoclavicular joint

Fig xv 6
Fig xvi 5

The two anterior borders do not however meet at the sternal angle for the right lung on reaching the middle line passes vertically downwards as far as the level of the 6th or 7th chondro-sternal joint whilst the left lung runs down behind the left border of the sternum to the junction of the 4th costal cartilage with the sternum The *right lung* from the level of the 6th or 7th chondro-sternal joint sweeps outwards cutting across—

(1) The 6th costal cartilage in the lateral vertical line

(2) The 8th rib in the mid axillary line

(3) The 10th rib in the line of the inferior angle of the

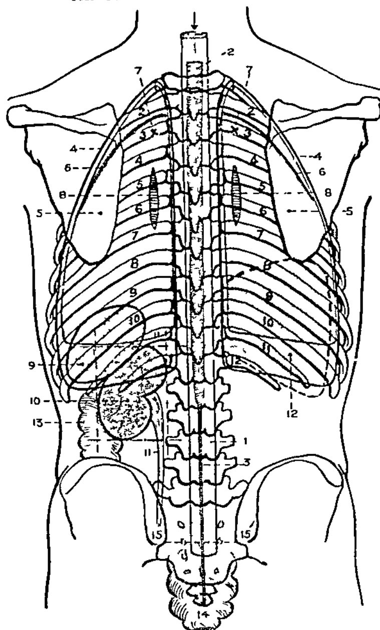


FIG XVI

1 1 The spinal dural sheath
2 The spinal cord
3 The filum terminale
4 4 The pleuræ
5 5 The lungs
6 6 The main oblique fissures of the lungs
7 7 The apex of the lower lobe of the lungs
8 8 The roots of the lungs
9 The spleen
10 The left kidney in Morris s parallelogram *
11 The ureter
12 The liver
13 The descending colon
14 The rectum
15 The posterior superior iliac spine

The tra erse proc ses f the first nd second l mbar ertebræ hould be drawn in ch manner as t om i to cont t w th the l rder of th kidney

To face p 44

scapula and finally passing inwards towards the 10th thoracic spine

The *left lung*, from the outer border of the sternum at the level of the 4th chondro-sternal joint passes outwards for a short distance along the lower border of the 4th costal cartilage, and then turns downwards and inwards in a curved direction to the 6th costal cartilage in the lateral vertical plane The lung then sweeps round the chest wall following a course similar to that already indicated as pursued by the right lung the left lung lying however at a slightly lower level

Stress should perhaps be laid on the fact that as the lower border of each lung sweeps round the antero-lateral, lateral and posterior aspects of the chest wall, from the 6th costal cartilage in front to the 10th thoracic spine *behind* the course pursued is practically transverse to the long axis of the body

It will be convenient to put here in a tabulated manner the *comparative lower levels of the right pleura and lung Starting in each case at the 6th right chondro-sternal joint* the pleura and lung may be represented by lines which traverse the chest wall cutting across the—

	Pleura	*Lung*
(1) Lateral vertical plane	8th costal cartilage	6th costal cartilage
(2) Mid axillary line	10th rib	8th rib
(3) Scapular line	11th rib	10th rib
(4) and sweeping inwards towards the	12th spine	10th spine

The numbers to be remembered are therefore, 6, 8 10 11 and 12 for the *pleura* and 6 6 8 10 10 for the *lung*

On the left side the levels are similar with two main exceptions—(*a*) the lung and pleura sweep outwards so as to leave a part of the heart uncovered (see '*superficial*

cardiac dullness) (*b*) both lung and pleura descend to a slightly lower level

The Lower Limit of the Lung the Pleura and the Liver in the Right Mid axillary Line

(1) The lung corresponds to the *8th rib*
(2) pleura *10th rib*
(3) liver , *costal margin* or even lower

The fissures of the lungs —The main fissure of each lung, Fig xv 7 Fig xvi 6 is indicated by a curved line which starts behind at the level of the *2nd thoracic spine* the apex of the main lower lobe of each lung therefore being situated immediately below and lateral to this thoracic spine When the arms fall naturally to the side of the body the line representing the main fissure cuts across the infraspinous surface of the scapula and crossing then the 5th rib in the mid axillary line terminates in front at the inferior border of the lung at the level of the *6th costochondral joint* When the arms are extended above the head the inferior angle of the scapula slides upwards and outwards on the chest wall In this position the main fissure is represented by a line from the *2nd thoracic spine* which passes downwards and outwards to the inferior angle of the scapula and then forwards to the termination of the fissure at the inferior border of the lung

The smaller or transverse fissure of the right lung separates off from the main fissure in the mid axillary line Fig xv 8 and passes almost transversely forwards along the lower border of the *4th rib and costal cartilage* to the anterior border of the lung It is thus manifest that the anterior aspect of the chest above the level of the *6th costal cartilage* corresponds to the upper

two lobes of the right lung and to the upper lobe of the *left lung* whilst the posterior aspect of the chest below the level of the 2nd thoracic spine corresponds to the right and left main lower lobes.

The *apices of the upper and lower lobes* —It will be here in place to again lay stress on the fact that the *apex of the upper main lobe* lies about 1 inch above the clavicle in the supraclavicular fossa, under cover of the clavicular head of a well-developed sternomastoid muscle and that the apex of the lower lobe lies immediately below and lateral to the spine of the 2nd thoracic vertebra

Fig xv
Fig xvi, 7

The *roots of the lungs* lie opposite the spines of the 4th 5th and 6th thoracic vertebræ and the bodies of the 5th 6th and 7th They may be so represented lying also midway between the middle line of the back and the vertebral border of the scapula the arms hanging loosely from the shoulders

Fig xvi, 8

The *areas of deep and superficial cardiac dullness* —

1 The area of *deep cardiac dullness* quadrate in form corresponds to the complete area already mapped out as representing the projection of the heart on to the anterior aspect of the chest wall

Fig xiv, 1–4

2 The area of *superficial cardiac dullness*, more or less triangular in shape corresponds to that part of the heart which is not covered by the thin anterior margin of the lung This area can with suffici[illegible] be defined

and the base by a line which passes laterally from the level of the 7th costal cartilage to the position of the apex beat

A reference to Figs xiv and xv will make it evident that *paracentesis of the pericardium* can be performed without injury to pleura or lung in the 5th left intercostal space The internal mammary artery runs vertically downwards about ½ inch from the outer border of the sternum and the needle should therefore be inserted through the 5th intercostal space about 1 inch from the outer border of the sternum

The *trachea and bronchi* —The trachea 4½ inches long commences immediately below the cricoid cartilage on a level with the 6th cervical vertebra and passing downwards through the superior mediastinum *bifurcates opposite the level of the lower part of the body of the 4th thoracic vertebra* (Louis plane)

Fig xv 1

The two bronchi diverge the left being the longer and the narrower The tendency of foreign bodies to pass more frequently into the right bronchus is explained by the fact that the septum between the two bronchi is placed to the left of the middle line of the trachea The right bronchus previous to the giving-off of the eparterial bronchus is less obliquely inclined than the left bronchus though subsequently it follows much the same course

Fig xv 2 3 4

The greater obliquity of the left bronchus accounts also for the fact that the left pulmonary artery tends to lie at the higher level whilst the right pulmonary artery lies below the level of the corresponding bronchus

The *œsophagus* 9 inches long also commences at the level of the cricoid cartilage and passing downwards through the superior and posterior mediastina pierces the diaphragm at the level of the

Fig xix 1 1

10th thoracic vertebra entering the stomach at the level of the 11th thoracic vertebra

The entrance of the œsophagus into the stomach may be indicated by taking a point on the 7th left costal cartilage ½ inch away from the left side of the xiphisternal joint

The *thoracic duct* 15 to 18 inches long commences at the cisterna chyli, a spindle shaped sac which lies Fig xx 5 opposite the bodies of the 1st and 2nd lumbar vertebræ and between the thoracic aorta on the left and the lumbar azygos on the right It may be represented on the surface by an oval enlargement placed just to the right of the middle line occupying the upper two-thirds of the space between the transpyloric (1st lumbar) and subcostal (3rd lumbar) planes

The efferent duct pierces the diaphragm through the Fig xx 6 aortic orific opposite the 12th thoracic vertebra and passes almost vertically upwards through the posterior mediastinum just to the right of the middle line as far as the lower part of the 4th thoracic vertebra (Louis s plane) The duct now crosses behind the œsophagus to the left of the middle line and then again passes vertically upwards through the superior mediastinum and into the neck as far as the level of the transverse process of the 7th cervical vertebra Finally the duct curls outwards and downwards to open into the Fig xx 7 angle between the internal jugular and subclavian veins of the left side The duct drains the whole of the lymphatic area of the body except the right side of the head and neck the right arm, the right side of the thorax and the convexity of the liver the lymphatics from these regions draining into a smaller duct which opens into the angle between the right internal jugular and subclavian veins

CHAPTER IV

THE ABDOMEN

The anterior aspect of the trunk (*i e* thorax and abdomen) is divisible into right and left halves by a *median vertical plane* from the middle point at the suprasternal notch above to the pubic symphysis below Each half is again divided by a *lateral vertical plane* which is drawn parallel to the median plane half way between that plane and the anterior superior iliac spine Prolonged downwards this lateral plane crosses the inguinal (Poupart s) ligament rather nearer to the medial than to the lateral end Prolonged upwards it crosses the clavicle about midway between the median point at the suprasternal notch and the acromioclavicular joint

Fig xvii, 3 3

Fig xvii 4 4

That part of the lateral vertical plane which traverses the mammary region is sometimes called the mammary plane that part which crosses the clavicle the clavicular plane and the downward prolongation which cuts across the inguinal ligament the Poupart plane

The clavicular mammary and Poupart planes are however continuous and they together form the *lateral vertical plane* which is chosen in preference to the mid Poupart plane of many anatomists since it is measured from the median plane to a fixed bony point Two vertical planes only will be consequently retained in the subdivision of the anterior aspect of the trunk—the *median and lateral vertical planes*

The median plane can be bisected by a horizontal plane which is on the same level as the body of the first lumbar vertebra. This plane so constantly cuts across the pyloric end of the stomach that it is called the *transpyloric plane* (of Addison) and it will be found that not (Fig. xvii) only does this plane lie half way between the suprasternal notch and the pubic symphysis, but that it also lies midway between the umbilicus and the xiphisternal joint. It is therefore not necessary to expose the whole of the anterior aspect of the trunk in order to verify the position of the transpyloric plane—a plane of the greatest value in defining the position of several abdominal viscera.

The point at which the *median vertical* and *transpyloric planes* intersect has been suitably called the 'central point' (Fig. xvii 1) and the point of intersection of the *lateral vertical* and *transpyloric planes* may be tentatively called the 'lateral central' or 'paracentral point' (Fig. xvii 2). This latter point usually corresponds to the anterior extremity of the ninth costal cartilage.

The distance between the 'central point' and the top of the pubic symphysis is bisected by a horizontal plane which passes through the tubercles of the iliac crests, the *transtubercular plane* (Fig. xvii), a plane corresponding to the level of the body of the fifth lumbar vertebra. It has also been suggested that the distance between the 'central point' and the suprasternal notch should likewise be bisected by a plane—the *thoracic plane*—which crosses the body of the sternum at the level of some part of the anterior extremities of the fourth costal cartilages (Fig. xvii). This plane is, however, of little value and is merely mentioned as completing

THE ABDOMINAL AND THORACIC PLANES

Level of hard palate — 1st cervical
Level of free margin of upper teeth = 2nd cervical
Level of hyoid bone = 2nd to 3rd cervical
Level of upper part of thyroid cartilage = 4th cervical
Level of cricoid cartilage = 6th cervical

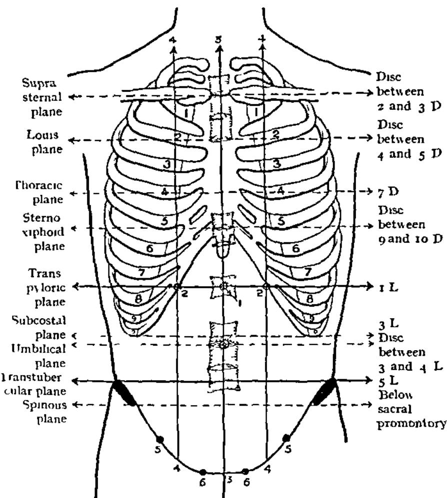


FIG XVII

1 The central point
The lateral central or paracentral point
3 3 The median vertical plane
4 4 The lateral vertical plane
5 5 The mid point of the inguinal ligament
6 6 The pubic spines

T fac p 5

the symmetrical subdivision of the median vertical plane into four equal parts

The following planes are therefore, chosen as the most scientific in the subdivision of the anterior aspect of the trunk

Two vertical planes—(1) The median, (2) the lateral

Three transverse planes—(1) The transtubercular (2) the transpyloric, (3) the thoracic

Two important points are also named—(1) The central point (2) the lateral central point

The abdominal regions mapped out by the intersection of the transpyloric and transtubercular planes with the lateral vertical planes receive the same nomenclature as in the older methods of regional subdivision of the abdomen These regions are nine in number

Fig xviii 1 Right hypochondriac 2 Epigastric 3 Left hypochondriac 4 Right lumbar 5 Umbilical 6 Left lumbar 7 Right iliac 8 Hypogastric 9 Left iliac

Other Transverse Planes with their Corresponding Vertebral Levels

(a) The *suprasternal plane* on a level with the disc between the 2nd and 3rd thoracic vertebræ Fig xvii

(b) *Louis plane* (junction of manubrium and body of the sternum) on a level with the disc between the 4th and 5th thoracic vertebræ *

(c) The *sterno xiphoid plane* (junction of sternum and xiphoid process) on a level with the disc between the 9th and 10th thoracic vertebræ

* The manubrium and body of the sternum unite at an angle known as the sternal angle (Louis)

(*d*) The *subcostal plane* on a level with the lower part of the 3rd lumbar vertebra

(*e*) The *umbilical plane* on a level with the disc between the 3rd and 4th lumbar vertebræ

(*f*) The *spinous plane* drawn between the two anterior superior iliac spines and usually falling below the level of the sacral promontory

The *lineæ semilunares* corresponds to the lateral border of the rectus abdominis muscle and extends with a slight outward convexity from the pubic tubercle below to the tip of the 9th costal cartilage above (the lateral central point)

Fig xviii 7

The *lineæ transversæ* result from the tendinous intersections in the rectus abdominis muscle They are three in number and are situated—(1) at the level of the umbilicus (2) midway between the umbilicus and the xiphoid cartilage (3) immediately below the xiphoid cartilage

Fig xviii, 8

The *arcuate line* (semilunar fold of Douglas) representing the lower limit of the posterior lamella of the rectus sheath lies about half way between the umbilicus and the upper border of the pubic symphysis

Fig xviii 9

The *umbilicus* usually lies 1 to 1½ inches above the transtubercular plane and corresponds to the level of the disc between the 3rd and 4th lumbar vertebræ The umbilicus is however so inconstant in position that the umbilical plane is rejected as often as possible in favour of a more definite and scientific plane

Fig xviii 4

The *iliac spines and crest*.—When the body is in the dorsal recumbent position the anterior superior iliac spine is usually visible to the eye and no palpation is needful in order to fix its position In the obese however, it is

ABDOMINAL PLANES ETC

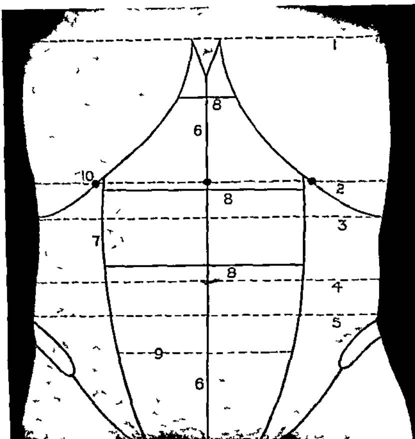


FIG XVIII

1 Sterno-xiphoid plane
2 Transpyloric plane
3 Subcostal plane
4 Umbilical plane
5 Transtubercular plane
6 Linea alba
7 Linea semilunaris
8 Lineæ transversæ
9 Arcuate line (semilunar fold of Douglas)
10 Anterior renal point

generally necessary to trace forward the iliac crest to its anterior termination By tracing the iliac crests in a backward direction the iliac tubercles will be found, lying about 2 to 2½ inches behind the anterior superior spines and a line uniting these two tubercles (*the trans tubercular plane*) corresponds to the level of the 5th lumbar vertebra Posterior to these tubercles the iliac crests rise to a higher level so that a line passing round the body at the *highest* level of the crests cuts the middle line of the back at the level of the interspace between the laminæ of the 3rd and 4th lumbar vertebræ (see *lumbar puncture* p 67) Still further backward the posterior superior iliac spines will be found at the posterior termination of the

Fig xxi 1 iliac crest A line which joins the posterior superior iliac spines cuts across the spine of the 2nd sacral vertebra

The *pubic tubercle* lies at the lateral extremity of the

Fig xvii 6 6 pubic crest In the male it is advisable to invaginate the scrotum in order to locate the position of this tubercle whilst in the female, owing to the prominence of the mons pubis it is usually necessary to abduct the thigh to feel for the rounded tendon of the adductor longus muscle and to trace this tendon up to its origin from a depression on the pubic bone which is situated immediately below and internal to the pubic tubercle

In the erect position of the body the pubic symphysis is nearly horizontal the inner or pelvic surface looking upwards and only slightly backwards whilst the external surface faces downwards and a little forwards The pubic crest is therefore practically directed forwards and the pubic arch backwards A knife inserted horizontally backwards immediately above the pubic symphysis would pass above the upper limit of the prostate gland and below

the promontory of the sacrum whilst if directed horizontally backwards below the pubic symphysis it would pierce the prostate near its centre and pass below the level of the tip of the coccyx

The *inguinal canal.*—In the adult this canal is about 1½ inches long and extends from the deep to the superficial inguinal rings The *deep inguinal ring* a funnel shaped prolongation of the transversalis fascia is situated ½ inch above the mid point of the inguinal ligament The *superficial inguinal ring, formed by the splitting of the aponeurosis* of the external oblique muscle is triangular in shape, the base directed downwards and inwards and opening up immediately above the pubic tubercle whilst the apex is directed upwards and outwards

Fig xx, 19, 19
Fig xx 17, 17
Fig xx, 16, 16

The *lumbar triangle* (triangle of Petit) —This triangle is bounded anteriorly by the posterior border of the external oblique and posteriorly by the anterior border of the latissimus dorsi muscle whilst the base is formed by part of the iliac crest The external oblique is inserted into the anterior half of the iliac crest and the base of the triangle corresponds to 1 to 2 inches of the bone behind the mid point of the crest The triangle is subject to great variation in size the two bounding muscles converging rapidly above to form the apex of the triangle The floor is formed by the internal oblique muscle

THE ALIMENTARY CANAL

The *stomach*.—Capacity about 2 pints The *cardiac orifice* lies opposite the 11th thoracic vertebra and is situated about 4 inches away from the surface It corresponds in position to a point on the 7th costal cartilage 1 inch away from the lateral border of

Fig xix, 2

the xiphisternal joint The seventh costal cartilage is the lowest of the series of cartilages which articulate in front with the central xiphersternal bar and forms therefore the upper lateral boundary of the epigastric triangle The *pyloric orifice* lies opposite the 1st lumbar vertebra and corresponds in position to a point in the transpyloric plane just to the right of the middle line

Fig xix, 3

The *lesser curvature* is represented by a curved line convexity to the left uniting the above two points The *greater curvature* in the moderately distended condition of the stomach ascends to the lower border of the left 5th costal cartilage and rib lying immediately above and behind the apex of the heart Sweeping then downwards the greater curvature usually cuts the left costal margin at some part of the 9th costal cartilage and finally curves upwards and inwards to the pylorus The upper limit of the fundus of the stomach corresponds to the level of the left dome of the diaphragm

Fig xix 3

Thus the stomach may be represented diagrammatically but owing to the changes in shape which it undergoes during digestion it is impossible to indicate its appearance and dimensions on the surface with any real accuracy After barium X ray it appears more as a vertical tube the lower border before turning up to the pylorus descending to the level of or below the umbilical plane Perhaps it suffices to indicate the two more or less fixed points cardiac and pyloric orifices and to draw a some what U-shaped organ between the two

The *duodenum* —Total length about 10 inches Part 1 = 2 inches part 2 = 3 to 4 inches part 3 = 4 to 5 inches

Fig xix 4 4 4

The pyloric orifice of the stomach lies opposite the 1st

5

lumbar vertebra and the first part of the duodenum is directed backwards, with a slight inclination upwards to the right side of the body of the 1st lumbar vertebra

Part 2 descends, on the right side of the median vertical plane from the level of the 1st lumbar vertebra (*trans pyloric* plane) to the level of the 3rd lumbar vertebra (subcostal plane) The third part of the duodenum passes almost transversely across the middle line at the level of the subcostal plane and having reached the left side of

Fig xix, 5 the middle line, ascends sharply *to the duodenojejunal* flexure which is placed on a level *with the 2nd lumbar vertebra* just below the transpyloric plane and 1 to 1½ inches to the left of the middle line The duodenum is subject to great variation in position and the description given merely represents the average situation of this loop of the small gut The pyloric orifice of the stomach and the duodenojejunal flexure are both fairly constant in position and between these two more or less fixed points the gut describes a loop which varies *both in shape and in extent*

The *pancreas* —The head of the pancreas occupies the

Fig xix 4 concavity of the duodenal loop the body crossing the middle line at the level of the 1st and 2nd lumbar vertebræ and occupying therefore the upper *two-thirds of the space* between the transpyloric (1st lumbar) and subcostal (3rd lumbar) planes The tail of the pancreas extends to the left as far as the hilum of the spleen

The *small intestine* is about 23 feet in length the upper two fifths being known as *the jejunum* *the lower three fifths* as the ileum

The *mesenteric attachment* of the small gut extends from

Fig xix 6 a point 1 to 1½ inches to the left of the middle line and just below the transpyloric plane

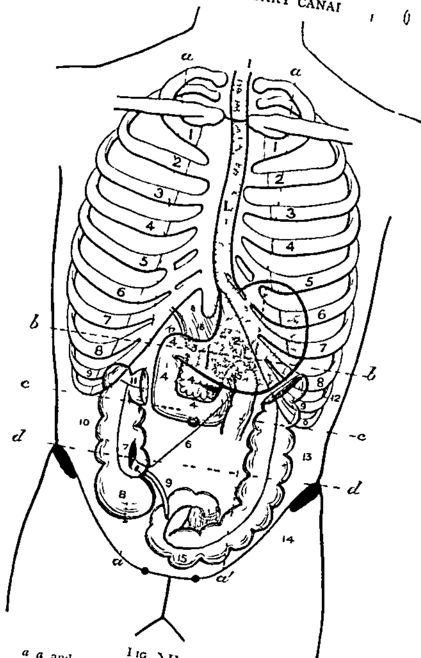


FIG XIX

a a and *a a* = the lateral vertical planes
b b The transpyloric plane
c c The subcostal plane
d d The transtubercular plane

To face p 56

FIG XIX

1 1 The œsophagus
2 The stomach
3 The pylorus
4 4 4 The three parts of the duodenum 4 The pancreas
5 The duodenojejunal flexure
6 The attachment of the mesentery of the small intestine
7 The ileocolic valve
8 The cæcum
9 The vermiform appendix
10 The ascending colon
11 The right colic flexure
12 The left colic flexure
13 The descending colon
14 The iliac colon
15 The ilio-pelvic colon
16 The lesser omentum (gastro-hepatic)
17 The aditus to the lesser sac (foramen of Winslow)
18 The common bile-duct

N B—The transverse colon has been intentionally omitted

(duodenojejunal flexure), to the junction of the right lateral vertical and transtubercular planes The line drawn between these two points should pass at first obliquely outwards and downwards to the right iliac fossa curving finally outwards to the region of the ileocolic valve

The *ileocolic valve* is placed opposite the junction of the right lateral vertical and transtubercular planes
Fig xix 7

The *cæcum* is about 2½ inches long and the long axis of the sac is directly downwards forwards, and inwards This blind end of the large gut lies below the level of the transtubercular plane and occupies the right iliac fossa and part of the right half of the hypogastric region
Fig xix 8

The *vermiform appendix* —The opening of the appendix into the cæcum is situated just below and medial to the junction of the right lateral vertical and transtubercular planes at the top right hand corner of the hypogastric region The surface marking of the cæcal orifice of the appendix does not coincide with McBurney s point which is situated at the junction of the outer and middle thirds of a line drawn from the right anterior superior iliac spine to the umbilicus (spino umbilical line) This point represents the usual seat of maximum pain on palpation in an attack of appendicitis The appendix is usually 3 to 4 inches long and is directed downwards and inwards overhanging the pelvic brim, upwards and inwards *towards the spleen or vertically* upwards behind the cæcum Stress should be laid on the fact that the ileocolic valve and the cæcal orifice of the appendix are both situated on the postero medial aspect of the cæcum
Fig xix 9

The *ascending colon* passes upwards from the level of
Fig xix, 10 the transtubercular plane to the upper part of the 9th right costal cartilage, the gut there turning on itself to form the *right colic* flexure In its upward course the ascending colon lies almost entirely to the right of the right lateral vertical plane

The *transverse colon* extends from the *right colic* flexure
Fig xix, 11 on the right to the *left colic* flexure on the left The former flexure corresponds to the 9th costal cartilage, whilst the latter reaches upwards as high as the 8th In between these two points the gut varies greatly in direction in different subjects Most commonly the gut passes almost transversely from one side to the other crossing the middle line at about the level of the 2nd lumbar vertebra It also crosses the second part of the
Fig xix 12 duodenum, and lies therefore, usually above the umbilical plane In the diagram the two flexures are depicted but the intervening portion of the gut has been omitted intentionally

The *descending colon* passes almost vertically downwards
Fig xix, 13 from the region of the left colic flexure to the level of the posterior part of the iliac crest below which level it becomes known as the *iliac colon* The descending colon lies wholly to the left of the left lateral vertical plane

The operation of lumbar colostomy is now seldom
Fig xvi 13 performed but it is nevertheless necessary to indicate the position of the descending colon on the posterior aspect of the trunk It corresponds in direction to a line drawn vertically upwards to the tip of the 12th rib, from a point situated ½ inch behind the mid point along the iliac crest between the anterior and posterior superior iliac spines

The *iliac and pelvic colon* —Between the termination of the descending colon at the level of the iliac crest and the beginning of the rectum proper at the level of the third piece of the sacrum the large gut describes so varied a course that no definite detailed account can be given of its surface marking It may however, be briefly described

Fig xix, 14

as passing downwards and inwards from the level of the iliac crest parallel to the inguinal ligament as far as the left side of the pelvic brim (the iliac colon) The gut then forms a great loop (the pelvic

Fig xix 15

colon) which sweeps over to the right side of the pelvic brim turning on itself to become the rectum at the level of the 3rd sacral vertebra

The *rectum* —A line which unites the two posterior superior iliac spines crosses the spinous process of the second sacral vertebra The rectum begins at the level of the third sacral vertebra and may be indicated on the surface by drawing in the gut as starting about ½ to ¾ inch below the above mentioned line and extending downwards following the curves of the sacrum and coccyx to the anal orifice which is placed about 2 inches below the level of the tip of the coccyx

The dura mater enclosing the spinal cord (see *spinal*

Fig xvi

cord) reaches downwards to the level of the 3rd sacral vertebra The spinal dura mater therefore terminates at the same level as the rectum begins—a point to be borne in mind in those operations carried out in the sacral region for the exposure of a growth involving the gut in the neighbourhood of the junction of the pelvic colon and the rectum

THE KIDNEY

(*Length*, $4\frac{1}{2}$ *inches breadth*, $2\frac{1}{2}$ *inches thickness*, $1\frac{1}{4}$ *inches weight* $4\frac{1}{2}$ *ounces*)

(*a*) *Anterior surface marking*—The two kidneys are Fig xiv, 32 obliquely placed in such a manner that the superior poles lie $1\frac{1}{4}$ to 2 inches and the inferior poles $2\frac{1}{2}$ to 3 inches distant from the middle line The left kidney lies at a slightly higher level than its fellow, and the hilum is placed just below and medial to the junction of the transpyloric and left lateral vertical planes in other words the hilum of the left kidney lies just medial to the anterior extremity of the 9th costal cartilage The upper pole lies half way between the sterno-xiphoid and transpyloric planes whilst the lower pole corresponds to the subcostal plane The right kidney does not ascend to quite such a high level, and the inferior pole lies opposite the umbilical plane The hilum of this kidney also lies just below the level of the hilum of the opposite kidney

(*b*) *Posterior surface marking*—*Morris's parallelogram* Fig xvi, 10 —Two vertical lines are drawn at a distance of 1 inch and $3\frac{1}{4}$ inches respectively from the middle line of the back and two horizontal lines are drawn outwards at the level of the spinous processes of the 11th thoracic and 3rd lumbar vertebræ In the parallelogram so marked out the kidneys are drawn, care being taken to place the long axis of each kidney in the required oblique direction

THE URETERS

(*Length* 10 *inches*)

(*a*) *Anterior surface marking*—The ureter passes nearly Fig xiv, 33 vertically downwards from the hilum of the kidney (just below and medial to the junction

of the transpyloric and lateral vertical planes *i e* from the tip of the 9th costal cartilage) and dips into the true pelvis in close relation to the bifurcation of the common iliac artery The intrapelvic course of the ureter is unsuited to any surface marking—it passes downwards and slightly backwards towards the spine of the ischium and then forwards to the base of the bladder

(*b*) *Posterior surface marking* —The course of the ureter on the posterior aspect of the trunk can be represented by a line drawn vertically upwards from the posterior superior iliac spine to the level of the spinous process of the 2nd lumbar vertebra

Fig xvi 11

The *ovary* lies in the angle between the internal and external iliac arteries immediately below the pelvic brim

Fig xiv 34

The *urachus* is directed upwards from the apex of the bladder at the upper border of the pubic symphysis to the umbilicus

Fig xx, 15

ABDOMINAL VESSELS

The *abdominal aorta* —The thoracic aorta enters the abdominal cavity by passing through the aortic opening of the diaphragm at the level of the 12th thoracic vertebra The vessel then changes its name and the abdominal aorta passes vertically downwards as far as the left side of the body of the 4th lumbar vertebra at which level it bifurcates into the two common iliac arteries The course of the vessel may be mapped out on the surface by taking a point about two fingers breadth above the transpyloric plane and slightly to the left of the middle line and by drawing a line vertically downwards to a second point situated $\frac{1}{2}$ inch below and to the left of the umbilicus

Fig xiv 24

The first large vessel which arises from the abdominal aorta is the *cœliac artery*. This trunk is given off at the level of the 12th thoracic vertebra and divides after a course of about ½ inch into three main trunks—the hepatic, splenic and left gastric arteries.

Fig xiv, 25

The *superior mesenteric* (level of disc between the 12th dorsal and the 1st lumbar vertebræ) follows next, springing from the anterior aspect of the aorta immediately above the transpyloric plane.

Fig xiv, 26

The *renals* (level of the 1st lumbar vertebra) pass outwards from the lateral aspect of the aorta immediately below the level of the transpyloric plane.

Fig xiv, 27

The *inferior mesenteric* (level of the 3rd lumbar vertebra) arises from the left side of the main trunk at about the level of the subcostal plane.

Fig xiv, 28

The *common iliac artery* corresponds to the upper third of a line drawn from a point ½ inch below and to the left of the umbilicus to a second point situated half way between the anterior superior iliac spine and the pubic symphysis. The *external iliac* artery corresponds in direction to the lower two-thirds of this line.

Fig xiv, 29

Fig xiv, 31

The *inferior epigastric artery* is given off from the external iliac just as that vessel passes under the inguinal ligament half way between the anterior superior iliac spine and the pubic symphysis. The epigastric artery then passes upwards and inwards along the medial side of the deep inguinal ring towards a point immediately external to the umbilicus, entering the rectus sheath at the level of the arcuate line.

Fig xx 20

This vessel forms the lateral boundary of the inguinal

triangle (of Hesselbach) the medial boundary being
Fig xx 16 formed by the linea semilunaris of the same side and the base by the inguinal ligament Each triangle is subdivided in a vertical direction into two parts by the obliterated umbilical artery on either side of which herniæ may protrude

The *inferior vena cava* is formed by the junction of the two common iliac veins on the right side of the body of the 5th lumbar vertebra about 1 inch below and ½ inch to the right of the umbilicus The vein passes upwards
Fig xiv, 23 through the venacaval opening of the diaphragm at the level of the 8th thoracic vertebra entering the right auricle of the heart opposite the 5th right interspace and the adjoining part of the sternum

The Liver

The anterior border can be mapped out by drawing a
Fig xx 2 curved line from a point in the 5th left inter space 3½ inches from the middle line (the position of the apex of the heart) the line cutting the left costal margin at the tip of the 8th costal cartilage and the right costal margin at the tip of the 9th costal cartilage Between these two latter points the anterior border of the liver crosses the middle line half way between the umbilicus and the xiphisternal joint (= trans pyloric plane) whilst a notch to the right of the middle
Fig xx, 4 line indicates the hepatic attachment of the *ligamentum teres* which passes from that notch downwards and inwards to the umbilicus

Beyond the tip of the 9th right costal cartilage the
Fig xvi 12 anterior border of the liver follows the lower limit of the costal arch descending sometimes

even below that level, and after cutting across the 12th rib ascends towards the level of the 11th thoracic spine

The upper limit of the liver is indicated by a line starting as before in the 5th left interspace 3½ inches from the middle line and ascending slightly as it passes to the right This line cuts across the 6th right chondro-sternal articulation, the upper border of the right 5th costal cartilage in the right lateral vertical plane the 6th rib in the mid axillary line sweeping thence just below the angle of the scapula towards the 8th thoracic spine

Fig xx

The *gall bladder* —The fundus projects from under the anterior border of the liver in the angle between the tips of the 9th and 10th costal cartilages and the outer border of the rectus abdominis muscle

Fig xx, 3

The *diaphragm* —On ordinary inspiration the right dome of the diaphragm corresponds in level to the lower part of the 4th right interspace whilst the left dome ascends to the lower part of the 5th left rib and costal cartilage

Fig xx 1

THE COMMON BILE DUCT, ETC

The *lesser omentum* passing upwards from the lesser curvature of the stomach to the porta hepatis of the liver, presents a free edge, which looks downwards and to the right and which forms the anterior boundary of the *aditus to the lesser sac* (foramen of Winslow)—the channel of communication between the greater and the lesser peritoneal sacs The free edge of this omentum contains (between its two layers of peritoneum) three important structures

Fig xix 16

Fig xix 17

1 The common bile-duct to the right
2 The hepatic artery to the left

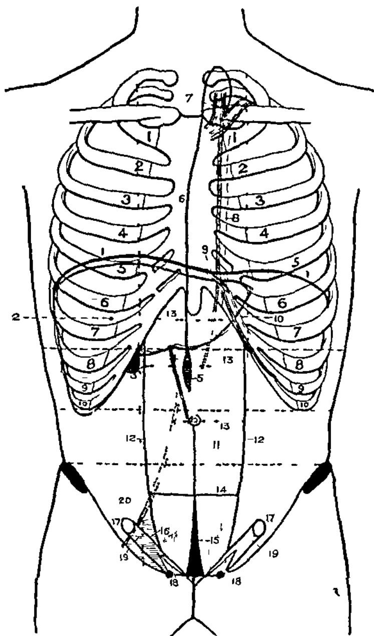


FIG XX

FIG XX

1 1 The diaphragm
2 The liver
3 The gall bladder
4 *The ligamentum teres*
5 The cisterna chyli
6 The thoracic duct
7 The venous termination of the duct
8 The internal mammary artery
9 The superior epigastric artery
10 *The musculo-phrenic artery*
11 The rectus abdominis muscle
12 12 The lineæ semilunares
13 13 13 The lineæ transversæ
14 The arcuate line (semilunar fold of Douglas)
15 The urachus
16 *The inguinal triangle (Hesselbach)*
17 17 The deep inguinal ring
18 18 The superficial inguinal ring
19 19 The inguinal canal
20 The inferior epigastric artery

3 The portal vein behind and between the two former structures

In mapping out any of these structures it is therefore advisable first to draw in the lesser curvature of the stomach, the pylorus the three parts of the duodenum and the pancreas The pylorus occupies such a definite position in the transpyloric plane that all these structures are easily and quickly drawn in The free margin of the lesser omentum should be represented as a curved line passing upwards and to the right for 1¼ to 2 inches from the duodeno pyloric junction The *portal vein* is formed behind the head of the pancreas by the union of the superior mesenteric and splenic veins and passes upwards to the porta hepatis of the liver behind the first part of the duodenum and in the free edge of the lesser omentum

The *hepatic artery* a branch of the cœliac artery passes upwards from the upper border of the first part of the duodenum in the free edge of the lesser omentum to the porta hepatis

The *common bile duct* is 3 inches long and is formed by the union of the common hepatic and cystic ducts It passes downwards in the free edge of the lesser omentum behind the first part of the duodenum behind the head of the pancreas and opens on the inner and posterior aspect of the second or descending part of the duodenum

Fig xix 18

✓The Spleen

The long axis of the spleen corresponds to the 10th rib and the viscus extends upwards to the upper border of the 9th rib and downwards to the lower border of the 11th rib The upper and inner pole lies 1½ to 2 inches away from the 10th thoracic spine

Fig xvi 9

whilst the lower or anterior pole reaches as far forwards as the mid axillary line

The Spinal Cord

The spinal cord extends from the foramen magnum to
Fig vii, 5 the lower border of the 1st lumbar vertebra
Fig xvi 2 (transpyloric plane) The cord *follows the* curves of the vertebral column and presents also two enlargements cervical and lumbar The former swelling lies between the 3rd cervical and 2nd thoracic vertebræ the latter between the 9th and 12th thoracic vertebræ Near its termination the cord tapers away as the *conus medullaris*

The *filum terminale* the prolongation of the cord is
Fig vii 7 continued onwards from the lower part of the
Fig xvi 3 body of the 1st lumbar vertebra to near the tip of the coccyx at which level it blends with the periosteum lining that bone

The spinal dural sheath extends as low as the 3rd
Fig vii 6 sacral vertebra at which level it is pierced by
Fig xvi 1 1 the filum terminale

A line uniting the two posterior superior iliac spines
Fig vii 10 cuts across the 2nd sacral spine and the dural
Fig xvi 15 sac therefore terminates about ½ inch below the level of this interspinous line At the third month of intra uterine life the cord extends the whole length of the vertebral canal whilst at birth it reaches as low down as the 3rd lumbar vertebra

A reference to Fig 7 will show that cerebro-spinal fluid might be withdrawn from the dural canal anywhere between the termination of the cord at the level of the transpyloric plane and the base of the sacrum A line drawn across the back at right angles to the long axis of

the body, at the level of the highest part of the iliac crests, cuts across the middle line of the back at the level of the interspace between the laminæ of the 3rd and 4th vertebræ It is at this point or rather to one side of this point that *lumbar puncture* is carried out

THE PERINEUM

A brief account only will be given as though the landmarks are most important the tendency is great to drift into the question of surgical applied anatomy—a pitfall which the writer is most anxious to avoid

The *perineum* is in shape roughly quadrilateral the lateral boundaries being formed in front by the diverging rami of the pubis and ischium and behind by the ischial tuberosity and the gluteus maximus muscle The anterior and posterior angles of the space are formed respectively by the pubic symphysis and the tip of the coccyx The pubic arch angle is obtuse in the female and acute in the male In the female also the ischial tuberosities are further apart and slightly everted The *perineum* is divided into two areas by a line drawn between the anterior part of the ischial tuberosities, thus forming—

(*a*) The urogenital area
(*b*) The anal area

This transverse line passes about 1 inch in front of the anus and represents the level of the two transversus perinei superficialis muscles the posterior border of the perineal membrane (triangular ligament) and the line along which the membranous layer of the superficial fascia (Colles fascia) is reflected round the posterior border of the two transverse perinei muscles to become continuous with the posterior border of the perineal membrane The *central tendinous point of the perineum*

(perineal body), corresponds to the middle of this line and forms the point of attachment of several muscles

(*a*) The *urogenital area* —In the *male* this area is divided into two lateral triangles by the median antero-posterior prominence of the bulb of the penis (corpus spongiosum) The two crura of the penis (corpora cavernosa) diverge as they pass backwards towards the tuberosity of the ischium and the main pudendal vessels lie under cover of these erectile organs The triangle is completed behind by the transversus perinei muscle All the above mentioned erectile structures and muscles lie superficial to the perineal membrane

In the *female* this area is practically cut into two lateral triangles, by the orifice of the vagina each side of which lies the bulb of the vestibule an organ of erectile tissue corresponding developmentally to the male corpus spongiosum More superficially, the two labia majora converge towards the mons pubis in front whilst on the inner aspect of the labia majora, the labia minora converge towards the clitoris between which body and the vaginal margin a smooth triangular space exists—the *vestibule* At the junction of the vagina and *the vestibule the urethra opens*

Vaginal examination —Passing along the posterior vaginal wall the finger enters the posterior fornix the upper part of which is in *direct relation with the peritoneal cavity* (Douglas s pouch) Along the anterior wall the smaller anterior fornix is first encountered, this *cul-de sac* not being directly related to the peritoneal cavity, and immediately above this the *cervix uteri* may be examined Bimanually much information can usually be gained with regard to the size and position of the uterus, the condition of the uterine appendages the contents of Douglas s pouch etc

(*b*) *The anal area* —This area is divided into two lateral parts by a line drawn from the central point of

the perineum to the tip of the coccyx and the examining fingers may in thin subjects be made to sink deeply into each lateral recess (the ischiorectal fossæ) being then in relation with the rectum and levator ani muscle on the inner side the ischial tuberosity and the obturator internus muscle on the outer side the transverse perinei muscle in front and the gluteus maximus and sacro tuberous ligament behind

Rectal examination —If the forefinger be gently inserted into the rectum definite resistance is offered by the external and internal sphincters the latter aided by contraction of the levator ani muscle Further on the finger enters the dilated ampullary portion of the rectum meeting perhaps further obstruction from the transverse rectal folds (valves of Houston) When insinuated as far as possible the palmar aspect of the distal phalanx will in the male be in contact with the vasa deferentia the vesiculæ seminales and the base of the bladder the middle phalanx with the prostate gland and the proximal phalanx with the sphincters which intervene between the finger and the perineal membrane and the spongy and membranous parts of the urethra Posteriorly the hollow of the sacrum and the coccyx can be explored It is most important to bear in mind that the peritoneum is reflected from the rectum on to the *upper third of the vagina in the female and on to the vesiculæ seminales about 1 inch above the upper limit of the prostate gland in the male*

In *children* since the true pelvis is but little developed and the later pelvic viscera are practically abdominal a rectal examination enables one to explore all the lower abdominal viscera including the bladder

In the *female* the cervix uteri can be felt projecting against the anterior rectal wall

CHAPTER V

THE LOWER LIMB

THE pubic tubercle the iliac crest, the anterior and posterior superior iliac spines and the iliac tubercles have all been alluded to previously and located It has also been stated that a line uniting the two posterior superior iliac spines cuts across the spine of the 2nd sacral vertebra Below this line the remaining sacral spines and the coccyx are easily felt, though the coccyx itself is more readily verified by inserting the forefinger into the rectum whilst the thumb is placed over the bone externally

Fig xxi

The region of the hip—(a) *Posterior and lateral aspect* The greater trochanter of the femur and the ischial tuberosity must now be examined *The latter process* lies under cover of the lower part of the gluteus maximus muscle, whilst the trochanter is subcutaneous in its lower part and covered over in front and above by the insertion of the gluteus medius muscle

The trochanter is more or less quadrilateral in shape fading off into the shaft of the femur below and presenting a well marked posterior border the highest point of the trochanter corresponds to the posterior superior angle of the quadrilateral When the body is in the erect position, there is a well-defined depression situated above and behind the great trochanter which becomes less marked when as the result of disease

Fig xxi 2
Fig xxiv 6

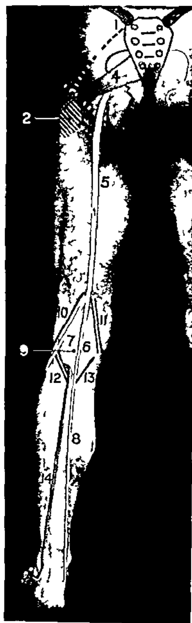


Fig XXI

T fac p 7

FIG XXI

1 Posterior superior iliac spine
2 Greater trochanter of femur
3 Nélaton's line from ischial tuberosity to the anterior superior iliac spine cutting across the summit of the greater trochanter
4 Piriformis muscle
5 Sciatic nerve
6 Medial popliteal nerve
7 Lateral popliteal nerve
8 Posterior tibial nerve
9 Popliteal space
10 Biceps tendon
11 Semimembranosus and semitendinosus
12 Plantaris and lateral head of gastrocnemius
13 Medial head of gastrocnemius
14 The short saphenous vein

or disuse the gluteus maximus undergoes atrophic changes The fold of the nates does not correspond to the lower border of the gluteus maximus muscle as it crosses almost transversely the lower oblique fibres of that muscle This fold also becomes less distinct when the glutei muscles degenerate The head and neck of the femur form with the shaft of that bone an angle of 125 *to* 130 *degrees*

Fig xxi

Nélaton s line — If in the normal state you examine the relation of the greater trochanter to the other bony prominences of the pelvis you will find that the top of the greater trochanter corresponds to a line drawn from the anterior superior iliac spine of the ilium to the most prominent point of the tuberosity of the ischium This line also runs through the centre of the acetabulum The extent of displacement in dislocation or in fracture is marked by the projection of the trochanter behind and above this line (Nélaton)

Fig xxi 3
Fig xxiv 5

Bryant s triangle —When the patient is in the dorsal recumbent position draw a line round the body at the level of the anterior superior iliac spine and from this line drop a perpendicular to the top of the great trochanter To complete the triangle draw a line from the anterior superior iliac spine to the top of the trochanter When the trochanter is displaced upwards the perpendicular line is diminished in length as compared with the sound side and when it undergoes a backward displacement the spino trochanteric line is relatively increased in length

Fig xxiv 4

(*b*)—Anterior and medial aspect The lower limb is demarcated from the abdomen by a well marked furrow the *inguinal groove* This corresponds to the situation of the inguinal ligament (*Poupart s ligament*) the recurved

lower border of the obliquus externus abdominis muscle This ligament as it passes from the anterior superior iliac spine to the pubic tubercle of the same side forms the upper boundary of the *femoral triangle* (Scarpa s triangle) a space which is best demonstrated when the thigh is Figs xxii, xxiii flexed abducted and everted The sartorius muscle is then thrown into action and the outer boundary of the space so shown If the hand be now placed on the upper and inner aspect of the thigh and the limb be sharply adducted a rounded tendon at once becomes noticeable This is the adductor longus which forms the inner boundary of the femoral triangle

The outwardly directed adductor longus and the inwardly curving sartorius converge to form the apex of the triangle

The floor of the space is formed from without inwards by the iliacus psoas major, pectineus and adductor longus muscles In the superficial fascia which overlies this region numerous lymphatic glands are situated and it will here be convenient to discuss briefly their general arrangement The *superficial lymphatic glands* are placed in three main groups

(1) The *oblique or inguinal* glands, running parallel to and below the inguinal ligament and draining the anterior aspect of the abdomen below the level of the umbilicus the lower half of the side and back the gluteal region and the upper and outer part of the thigh

(2) The *vertical or femoral* glands running with the long saphenous vein and draining the greater part of the inner aspect of the foot leg and thigh

(3) The *pubic* glands situated below and lateral to the pubic tubercle and draining mainly the external genitals perineum and anus

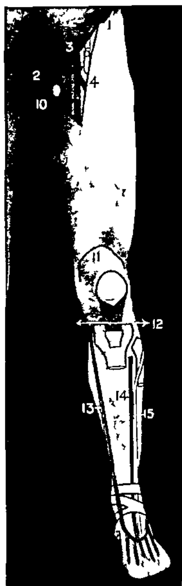


FIG XXII

FIG XXII

1 The anterior superior iliac spine
2 The pubic tubercle
3 The inguinal ligament (Poupart s ligament)
4 The sartorius muscle
5 The adductor longus muscle
6 The femoral nerve
7 Femoral arteries
8 Femoral vein
9 Femoral ring
10 Saphenous vein and opening
11 Upper limit of knee joint (subcrureus pouch)
12 Level of knee joint
13 The long saphenous vein
14 Anterior tibial artery
15 Anterior tibial nerve

The deep fascia presents an opening the *saphenous opening* for the transmission of the long saphenous vein to the femoral vein This foramen is oval in shape being 1 inch long and ½ to ¾ inch broad the long axis vertical The central point of the opening is situated 1½ inches below and 1¼ inches lateral to the pubic tubercle

Fig xxii, 10
Fig xxiii 13

Beneath the deep fascia overlying the femoral triangle certain important structures are situated, such as the femoral artery superficial branches and profunda femoris arteries, the corresponding veins and the femoral nerve These will all be dealt with later the femoral ring alone needing here further definition

The *femoral ring* through which a femoral hernia commonly escapes from the abdominal cavity lies below the medial part of the inguinal ligament and lateral to the pubic tubercle A good way to define the ring with precision is that recommended by Holden Feel for the pulsation of the (common) femoral artery, allow ½ inch on the inner side for the femoral vein, then comes the femoral ring The femoral ring presents the following boundaries To the inner side is Gimbernat s ligament* to the lateral side is the femoral vein in front is the inguinal ligament behind is the pectineus muscle and the horizontal ramus of the os pubis

Fig xxii 9
Fig xxiii 7

The *subsartorial canal* (Hunter s canal) a more or less triangular muscular channel for the transmission of the femoral artery occupies the middle third of the antero-medial aspect of the thigh During forcible contraction of the thigh muscles the femoral triangle may be seen to be continued downwards as a shallow depression between the extensor and adductor

Fig xxiii 10

* This is the lacunar ligament the pectineal reflection of the inguinal ligament

muscles, this furrow corresponding to the position of the canal in question The anatomical boundaries of the canal are (1) vastus medialis laterally (2) adductor posterior longus and magnus posterior (3) sartorius and a strong fascial band between the adductors and vastus medialis in front and medially

The canal transmits the femoral vein and artery the saphenous nerve and the nerve to the vastus medialis

In order to *compare the length* of the lower extremities the limbs should be placed parallel to one another, and the tape measure carried from the anterior superior iliac spine to the tip of the medial malleolus of the tibia of the same side The distance between these two points may be subdivided if necessary by marking out on the medial aspect of the knee the transverse line which indicates the level of the knee joint The lengths of the femur and of the tibia are thus separately estimated

Fig xxii 12

The *region of the knee*—The biceps tendon forms the upper and lateral boundary of the popliteal space, and under cover of this tendon on its medial or popliteal aspect a cord like structure is felt the *lateral popliteal nerve* This intimate relation of tendon and of nerve must be remembered in the operation of tenotomy of the biceps tendon If the biceps tendon be now traced downwards the head of the fibula is reached this process lying below lateral and on a posterior plane to the lateral tuberosity of the tibia The styloid process of the head of the fibula projects upwards from the posterior part of the head and in front of this the rounded long lateral ligament of the knee joint can be traced upwards to its femoral attachment In front of

Fig xxi, 9

Fig xxi 7 10

Fig xxiii 1 3

THE SIDE OF THE THIGH AND LEG

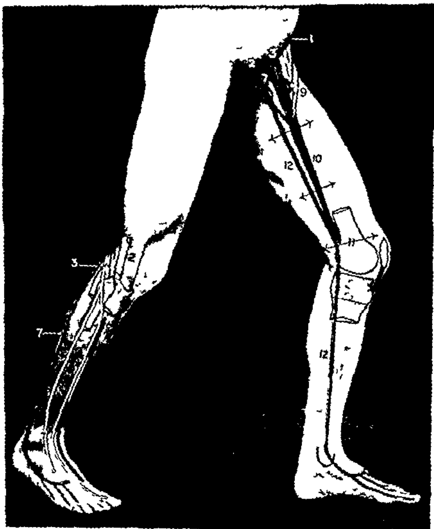


Fig XXIII

To face

THE SIDE OF THE THIGH

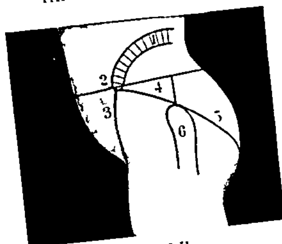


FIG XXIV

1 Iliac crest
2 Anterior superior iliac spine
3 The inguinal ligament
4 Bryant's triangle
5 Nélaton's line
6 Great trochanter of femur

To follow Fig XXIII

FIG XXV

Right foot

1 Peroneus longus
2 Peroneus brevis
3 Peroneal tubercle of calcaneum
4 Head of calcaneum and origin of the extensor digitorum brevis muscle
5 Peroneus tertius
6 Extensor digitorum longus
7 Innermost tendon of extensor digitorum longus

Left foot

1 Tibialis posterior
2 Flexor digitorum longus (passing over sustentaculum tali)
3 Flexor hallucis longus
4 Tendo calcaneus (Achilles)
5 Sustentaculum tali (of calcaneum)
6 Tuberosity of the navicular
7 Head of talus
8 Tibialis anterior
9 Extensor hallucis longus

under aspect by the peroneus longus tendon The tendon crosses the plantar aspect of the foot in a forward and inward direction, to be inserted into the lateral aspect of the base of the first metatarsal bone Immediately in

Fig xxv 4 front of the lateral malleolus there is a well marked depression which is bounded in front by a prominence due to the fleshy mass of the extensor digitorum brevis and above by the tendon of the peroneus tertius

If the floor of this depression be examined, the head of the talus will be felt above and to the medial side and the head of the calcaneum below and to the lateral side

Between the two malleoli in front of the ankle joint four tendons can be felt The most prominent and the

Fig xxv innermost is the tendon of the tibialis anterior muscle Lateral to this follow the extensor hallucis longus the extensor digitorum longus and the peroneus tertius When the foot is well extended the head of the talus can also be identified lying under cover of the extensor tendons

Fig xxv, 5 Fig xxv, 2 Immediately below the medial malleolus is the *sustentaculum tali* grooved on its under aspect by the flexor hallucis longus tendon

The tibialis posterior tendon can be traced upwards

Fig xxv 6 behind the medial malleolus and downwards to the tuberosity of the navicular bone to which process the tendon gains its main attachment In front of the medial malleolus there is another depression which lies below the line of the tibialis anterior tendon and here the head of the talus can again be felt especially pro-

Fig xxv, 7 Fig xxv 6 minent when the foot is well everted About 1 inch below and in front of the medial malleolus the tuberosity of the navicular bone

forms the most prominent bony point on the medial side of the foot and a line which joins the tip of the medial malleolus the head of the talus, and the navicular tubercle normally presents a slight upward convexity

Fig xxv

In flat-foot, the head of the talus undergoes a downward displacement and the line uniting the three bony points becomes straight or even downwardly convex

A line drawn almost transversely across the foot from a point proximal to the navicular tuberosity indicates the level of the *transverse tarsal joint*

Fig xxv

In front of the navicular tuberosity, the medial cuneiform and the first metatarsal bones may be located and verified

Behind the ankle joint the tendo calcaneus (Achilles) is placed the tendon being at its narrowest at a point about 1½ inches above its insertion into the posterior part of the calcaneum When distended with fluid the synovial membrane of the ankle joint bulges outwards so as to obliterate the depressions that normally lie between the tendo calcaneus and the two malleoli

Fig xxv, 4

/The *extensor retinacular ligaments of the ankle*—The superior portion of this ligament about 1 inch broad, extends transversely across the ankle from tibia to fibula It presents two compartments only one for the tibialis anterior, and one for the remaining extensor tendons The former tendon alone possesses a synovial sheath

Fig xxvi, 3

Fig xxvi 6

The inferior portion of the ligament is Y-shaped the single limb arising from the upper and lateral aspect of the head of the calcaneum in close connection with the origin of the extensor digitorum brevis muscle The upper limb of the divided portion

Fig xxvi, 4

THE REGION OF THE ANKLE AND FOOT

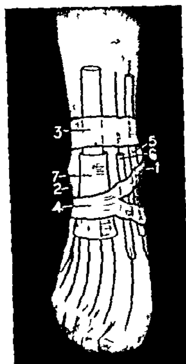


FIG XXXI

1 The medial malleolus
The lateral malleolus
3 The superior transverse band of the extensor retinaculum
4 The Y shaped inferior portion of the extensor retinaculum
5 The tibialis anterior synovial sheath
6 The extensor hallucis longus synovial sheath
7 The extensor digitorum longus and peroneus tertius synovial sheath

To face p 78

The *peroneal retinaculum* is less definite in shape and can only be described as a broad band passing from the lateral malleolus to the lower margin of the calcaneum

Fig xxviii, 1 2, 3, 4

Beneath it two tendons pass—the peroneus longus and brevis These two tendons possess a common synovial sheath, which extends upwards 2 to 3 inches above the tip of the lateral malleolus and downwards as far as the peroneal tubercle where the sac divides into two one part accompanying the peroneus brevis to near the base of the fifth metatarsal bone the other extending forwards to the outer and under aspect of the cuboid bone The

Fig xxix, 1, 4

peroneus longus is also usually enclosed in a synovial sheath in the last inch or so of its course, previous to its insertion into the lateral aspect of the base of the first metatarsal bone

The Vessels and Nerves of the Lower Limb

The *superior gluteal artery* emerges from the greater

Fig xxi

sciatic foramen, above the piriformis muscle, at the junction of the inner and middle thirds of a line drawn from the posterior superior iliac spine to the top of the greater trochanter of the femur of the same side

The *inferior gluteal artery* may be ligatured at a point

Fig xxi

which lies just lateral to the junction of the middle and lower thirds of a line drawn from the posterior superior iliac spine to the outer part of the ischial tuberosity of the same side This line also cuts across the *posterior inferior iliac spine* and the tip of the *ischial spine* whilst the *internal pudendal artery* lies immediately medial to the seat of election for ligation of the inferior gluteal artery

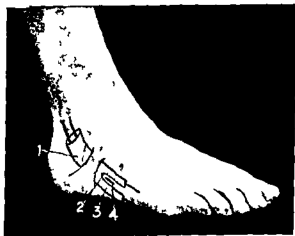


FIG XXXVIII

1 The peroneus longus and brevis synovial sheath
The peroneus brevis sheath
3 The peroneus longus sheath
4 The peroneal tubercle

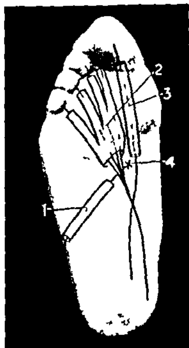


FIG XXXIX

1 The peroneus longus synovial sheath
The flexor digitorum longus synovial sheath
3 The flexor hallucis longus synovial sheath
4 The insertion of peroneus longus into base of 1st metatarsal bone

T face p o

The *femoral artery* —With the thigh flexed everted and slightly abducted this vessel corresponds in direction to a line drawn from a point midway between the anterior superior iliac spine and the pubic symphysis to the adductor tubercle of the femur below

Figs xxii and xxiii

The upper 1½ inches of this line = the femoral artery before the profunda femoris is given off

Fig xxiii 5

The upper third = the femoral artery in the femoral triangle

Fig xxii 7

The upper two-thirds = the complete course of the femoral artery

The middle third = the femoral artery in the subsartorial canal

Fig xxiii, 10

The *popliteal artery* enters the upper angle of the popliteal space (from the medial side) by passing between the femur and the adductor magnus tendon/The vessel at first passes obliquely outwards and downwards to the mid point of the space and then changes direction by passing vertically downwards as far as the lower border of the popliteus muscle at which level it bifurcates into anterior and posterior tibial arteries The point of bifurcation corresponds to the level of the tubercle of the tibia

The *anterior tibial artery* —The course of this vessel may be indicated by a line drawn from a point just below the level of the tibial tubercle and midway between the lateral tuberosity of the tibia and the head of the fibula to a second point in front of the ankle midway between the two malleoli at which level the artery lies between the tendons of the extensor hallucis longus and digitorum longus muscles

Fig xxii 14
Fig xxiii 6

The *femoral artery* —With the thigh flexed everted and slightly abducted the vessel corresponds in direction to a line drawn from a point midway between the anterior superior iliac spine and the pubic symphysis to the adductor tubercle of the femur below

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Fig xxii 14
Fig xxiii 6

The anterior tibial artery is continued onwards as the *dorsalis pedis* as far as the base of the first interosseous space

The *posterior tibial artery* starts at the lower border of the popliteus muscle as one of the terminal branches of the popliteal artery It can be represented by a line which starts at the inferior angle of the popliteal space, on a level with the tubercle of the tibia, and which passes downwards and inwards to the mid point between the posterior border of the medial malleolus and the medial border of the calcaneum At this level it lies under cover of the flexor retinaculum, and bifurcates in this situation into the medial and lateral plantar arteries Behind the medial malleolus the posterior tibial artery lies between the tendons of the flexor hallucis longus and digitorum longus muscles, but on a slightly superficial plane

The *medial plantar artery* passes forwards to the cleft between the first and second toes whilst (Fig xxix) the more important *lateral plantar artery* is first directed forwards and outwards towards the base of the fifth metatarsal bone and then changing direction passes forwards and inwards to the base of the (Fig xxix) first interosseous space, forming in this latter part of its course the *plantar arch* It anastomoses with the dorsalis pedis artery which dips downwards between the two heads of the first dorsal interosseous muscle

The *short saphenous vein* arises from the lateral side of (Fig xxi, 14) the venous arch on the dorsum of the foot passing upwards behind the lateral malleolus (Fig xxiii, 7) and along the lateral and posterior part of the leg to the middle of the popliteal space where it pierces the deep fascia to open into the popliteal vein It

is accompanied in the greater part of its course by the *sural nerve*, which extends forwards on the lateral side of the foot as far as the tip of the little toe

The *long saphenous vein* arises from the inner side
Fig xxii, 13 of the venous arch found on the dorsum of
Fig xxiii 12 the foot It passes upwards in front of the
medial malleolus along the inner side of the leg and knee behind the medial condyle of the femur / and its further upward course in the thigh is indicated by a line drawn from the adductor tubercle to the saphenous opening Attention has previously been drawn to the elevation below the medial tuberosity of the tibia which is formed by the sartorius gracilis and semitendinosus muscles and below this prominence the saphenous vein is accompanied by the *saphenous nerve* a branch of the deep division of the femoral nerve The saphenous nerve runs down the leg with the vein in front of the medial malleolus of the tibia and extends as far forwards as the ball of the great toe In the thigh the nerve crosses in front of the femoral artery from without inwards and accompanies that artery throughout the whole length of the subsartorial canal

The *femoral nerve* emerges from under cover of the
Fig xxii 6 inguinal ligament about half way between the
Fig xxiii 4 anterior superior iliac spine and the pubic
tubercle The nerve lies nearly ¼ inch lateral to the femoral artery and the same distance lateral to the femoral sheath

The *sciatic nerve* makes its exit from the pelvis
Fig xxi 5 through the greater sciatic foramen below the
piriformis muscle The nerve emerges from under cover of the lower border of the gluteus maximus muscle just to the medial side of the mid point between

the ischial tuberosity and the greater trochanter of the femur The nerve corresponds in direction to the upper *two thirds of a line* drawn downwards from the above *point to the middle of* the popliteal space below At the junction of the middle and *lower thirds of the thigh* the sciatic nerve divides into its two terminal branches—medial and lateral popliteal

The *posterior femoral cutaneous* (*small sciatic*) *nerve* lies in the same line as the sciatic but extends downwards as far as the inferior angle of the popliteal space

The *medial popliteal nerve* crosses the popliteal artery superficially from without inwards its onward continuation the *posterior tibial nerve* and the two terminal branches of the posterior tibial nerve the *medial and lateral plantars*, all have the same surface marking as the corresponding arteries Two points however need to be borne in mind first the posterior tibial nerve crosses the corresponding artery superficially from within outwards and downwards and, secondly, the medial plantar nerve is relatively much more important than the corresponding artery

Fig xxi 6, 8

The *lateral popliteal nerve* was last seen to lie under cover of the biceps femoris tendon at the upper and lateral boundary of the popliteal space The nerve follows the tendon downwards to the head of the fibula, and curls round to the antero-lateral aspect of the leg about 1 inch below the head of that bone dividing there *into its two terminal branches* anterior tibial and musculocutaneous

Fig xxi 7

The *anterior tibial nerve* passes downwards and inwards to join the corresponding artery lying lateral to the upper third of the artery, superficial to the middle third and *lateral again to the lower*

Fig xxii 15

third The nerve extends forwards along the lateral side of the dorsalis pedis artery as far as the cleft between the first and second toes, the contiguous sides of which toes it supplies

The *musculocutaneous nerve* running down in the substance of the peronei muscles becomes cutaneous below the middle of the leg It then passes obliquely downwards and inwards across the extensor retinaculum to be distributed to the greater part of the dorsal surface of the foot

Fig xxiii 5

THE WEIGHT OF SOME ORGANS

The brain Male, 50 ounces, female, 45 ounces

The lungs Together, 42 ounces right 22 ounces, left, 20 ounces

The heart Male 10 to 12 ounces, female, 8 to 10 ounces

The liver 50 to 60 ounces

The kidneys, 4½ ounces

The suprarenals, 1 to 2 drachms

The prostate ¾ ounce

The testis 1 ounce

The ovary, ¼ ounce

The spinal cord 1½ ounces

The pancreas 2 to 4 ounces

The spleen 7 ounces

1 ounce = 28 grammes

AN OUTLINE OF THE OSSIFICATION AND EPIPHYSES OF THE SKELETON EXCLUDING THE CRANIUM

Certain epiphyses and epiphyseal lines have been alluded to in the text and the following table compiled from Gray's Anatomy Frazer's The Anatomy of the Human Skeleton and Cunningham's Text book of Anatomy has consequently been appended

(a) THE UPPER LIMB

The Clavicle

Primary centre

1 for the shaft (in membrane) in the fourth or fifth week (i u l) *

Secondary centre

1 centre for the sternal end in the eighteenth to twentieth year

Union between the two in the twenty fifth year

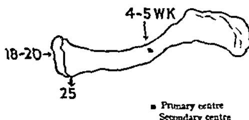


FIG 30—CLAVICLE

The Scapula

Primary centre

1 for the body in the eighth week (i u l)

Secondary centres

1 for the coracoid proper in the first year

1 for the subcoracoid region (lateral part of the root of the coracoid and upper one third of the glenoid cavity) in the tenth year

Union occurs at puberty

1 for the margins of the glenoid
1 for the inferior angle
1 for the vertebral border
2 for the acromion
} in the fifteenth year fusing between the twentieth and twenty fifth years

* i u l = intra-uterine life

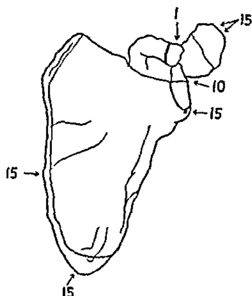


Fig 31 —Scapula

The Humerus

Primary centre

1 for the shaft in the eighth week (i u l)

Secondary centres

1 for the head in the first year

1 for the greater tuberosity in the third year

1 for the lesser tuberosity in the fifth year

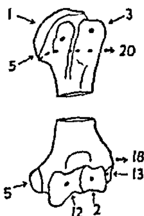


Fig 3? —Humerus

Head and tuberosities unite in the fifth year and with the shaft in the twentieth year

1 for the medial epicondyle in the fifth year

1 for half the trochlea in the twelfth year

1 for half the trochlea and capitulum in the second year

1 for the lateral epicondyle in the thirteenth year

The last three unite together to form an epiphysis which unites with the shaft in the seventeenth year the medial epicondyle joining separately in the eighteenth year

The Radius and Ulna

Primary centres

1 for the shaft of the radius in the ei hth week (i u l)

1 for the shaft of the ulna in the eighth week (i u l)

Secondary centres

1 for the lower end of the radius in the second year

1 for the lower end of the ulna in the sixth year

These unite with the shaft in the twentieth year

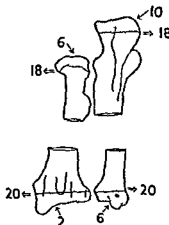


FIG 33—RADIUS AND ULNA

1 for the upper end of the radius in the sixth year

1 for the upper end of the ulna in the tenth year

These unite with the shaft in the eighteenth year

The carpus

All the bones are cartilaginous at birth The first centre of ossification appears in the os capitatum and the last in the pisiform Capitate and hamate first year—triquetrum third year—lunate trape

zium and scaphoid fifth and sixth years—trapezoid eighth year—pisiform twelfth year

The metacarpus and phalanges

Primary centres

1 for the shaft of each metacarpal in the ninth week

1 for the shaft of each phalanx between the eighth and the twelfth week

Secondary centres

1 for the head of each metacarpal bone and the base of each phalanx in the third year

Union between diaphyses and epiphyses in the twentieth year

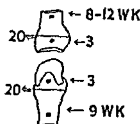


FIG 34 —METACARPAL and PHALANGES

The thumb metacarpal is an exception to the rule a well marked epiphysis always appearing at the base This bone therefore resembles a phalanx in its mode of ossification though an epiphysis is not infrequently seen in the head of the bone itself

(b) THE LOWER LIMB

The os coxæ

Three main primary centres for ilium ischium and pubis appearing respectively in the second third and fourth months (i u l) The three parts of the bone are separated at first by the Y shaped acetabular cartilage

Five secondary centres appear about puberty for the crest pubic symphysis anterior inferior iliac spine ischial tuberosity and the acetabular cartilage These unite at about the twenty fifth year

The femur

Primary centre

1 for the shaft in the seventh week (i u l)

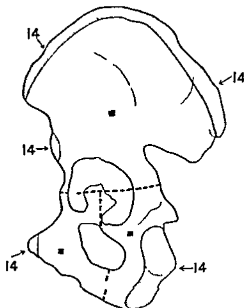


Fig 35 —Os Coxae

Secondary centres
- 1 for the head in the first year
- 1 for the greater trochanter in the fourth year
- 1 for the lesser trochanter in the fourteenth year
  These unite with the shaft in the eighteenth year
- 1 for the lower end in the ninth month (i u l)
  This unites with the shaft in the twentieth year

The patella
- 1 centre in the third year

The tibia and fibula

Primary centres
- 1 for the shaft of the tibia in the seventh week (i u l)
- 1 for the shaft of the fibula in the eighth week (i u l)

Secondary centres
- 1 for the upper end of the tibia in the first year
  Union occurs at the twentieth year
- 1 for the upper end of the fibula in the fourth year
  Union occurs at the twenty fourth year
- 1 for the lower end of the tibia in the second year
  Union at the eighteenth year
- 1 for the lower end of the fibula in the second year
  Union at the twenty first year

The tarsus

There are primary centres for each of the tarsal bones

1 for the Calcaneus in the sixth month
1 for the Talus in the eighth month
1 for the Cuboid in the ninth month (at birth)
1 for the 3rd Cuneiform in the 1st year
1 each for the Navicular 1st and 2nd Cuneiforms in the third year

The calcaneus possesses a secondary centre for its posterior surface appearing about the tenth year

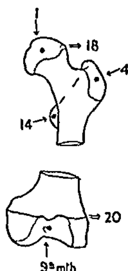


Fig 36—Femur

The metatarsus and phalanges

The centres appear as in the metacarpus etc

The vertebral column

There are three primary centres

1 for the body (starts in the lowest dorsal region and spreads from thence in both directions)
1 for each neural arch (starts at the axis and succeed one another from above downwards)
These appear in the seventh week (i u l) and by the third month there are primary centres in all vertebræ

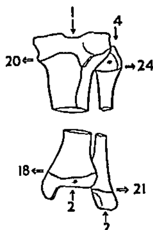


FIG 37 —TIBIA AND FIBULA

There are five secondary centres
1 for the tip of the spine
1 for each of the tips of the transverse processes
1 for the upper surface of the body
1 for the lower surface of the body
These appear at puberty and unite in the twenty first year

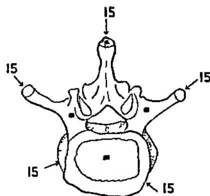


FIG 38 —VERTEBRA

The ribs

Primary centre

1 near the angle in the sixth week (i.u.l.)

Secondary centres

1 for the head 1 for the tubercle	At puberty and unite in the twenty fifth year

The manubrium and sternum

Primary centres

The manubrium in the fifth month The sternum	Fuse in old age

1st segment in the sixth month 2nd segment in the seventh month	Twenty first year	
2nd segment in the seventh month 3rd segment in the eighth month		Fifteenth year
3rd segment in the eighth month 4th segment in the ninth month	Childhood	
Xiphoid process in the third year	Middle decade	

The mandible

Develops in the first branchial arch from an ossification centre in membrane to the lateral side of Meckel's cartilage during the sixth week (i.u.l.)

The two halves fuse in the first year

INDEX